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# Rubber Research Scheme (Ceylon)

## Third Quarterly Circular for 1938.

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# Rubber Research Scheme (Ceylon).

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Office and Laboratories.—Dartonfield Estate, Agalawatta, Ceylon.

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# NOTICES.

## DARTONFIELD ESTATE—VISITORS' DAYS

The *second* and *fourth* Wednesdays in each month have been set aside as Visitors' Days at Dartonfield estate, and the services of technical officers will be available to visitors on those days. The estate superintendent will be available every Wednesday. Visitors are requested to arrive on the estate not later than 9-30 a.m.

While visitors will be welcomed at the Station on other days, any particular member of the staff may not be free to give them attention unless an appointment has been made.

Dartonfield estate is situated about 3½ miles from the main Matugama-Agalawatta Road, the turn-off being near culvert No. 14/10. The distance from Colombo is approximately 47 miles.

## PUBLICATIONS

Rubber Research Scheme publications comprising Annual Reports, Quarterly Circulars and occasional Bulletins and Leaflets, are available without charge to the Proprietors (resident in Ceylon) Superintendents and Local Agents of Rubber estates in Ceylon) over 10 acres in extent. Application for registration should be made to the Director, stating the name, acreage, and registered number of the estate(s) concerned.

## IDENTIFICATION OF CLONES

The attention of Proprietors and Superintendents undertaking replanting or budgrafting programmes is drawn to Planting Manual No. 5: "The History and Description of Clones of *Hevea Braziliensis*" issued by the Rubber Research Institute of Malaya, copies of which may be purchased on application to these Laboratories for Rs. 5-00 each (postage free.) This publication gives drawings and descriptive particulars of the more important clones, which should enable Superintendents to verify the authenticity of their material.

# FIELD EXPERIMENTS ON DARTONFIELD ESTATE—VII.

## MEASUREMENTS OF GROWTH IN REPLANTED AREAS.

R. K. S. MURRAY,
*BOTANIST & MYCOLOGIST.*

AND

C. A. DE SILVA,
*ASSISTANT BOTANIST*

THE first account of growth measurements in the experimental replanted areas on Dartonfield was given by the junior author in Rubber Research Scheme *Quarterly Circular*, Vol. 14, Parts 3 and 4, 1937. The following paper presents the measurements made in 1938.

For full accounts of the design of these experiments, details of replanting operations, etc. the reader is referred to the undermentioned issues of *The Quarterly Circular*:—

Vol. 11, Parts 3 and 4, 1934.

Vol. 13, Parts 2 and 3, 1936.

Vol. 13, Part 4, 1936.

For convenience the treatments and layout are recapitulated for each area.

### No. 1 REPLANTING EXPERIMENT, 1934
### CLEARING, 7½ ACRES.

The area is $7\frac{1}{2}$ acres and is divided into three blocks (replications) planted respectively with Clones Glenshiel 1, A.V.R.O.S. 256 and Prang Besar 25. Each block is divided into 4 strips running from top to bottom of the hillside planted respectively with the following ground covers:—

1. *Centrosema pubescens*
2. *Pueraria phaseoloides*
3. *Calopogonium mucunoides*
4. *Dolichos hosei* (*Vigna*).

At right angles to these strips each block is divided into 3 plots with the following methods of dealing with the old rubber timber:—

α Leaving all large timber lying unburned.

β Burning all timber *in situ*.

γ As but removing and burning all the larger lateral roots.

The "plaid shawl" arrangement arising from these strips and plots at right angles to one another results in unit plots of 16 trees, and each such plot is divided into two sub-plots with different methods of controlling the ground cover, as under:—

X Keeping individual platforms (15 feet long) clean weeded.

Y Ring weeding in a 6 feet circle round each tree.

The field was replanted with budded stumps in June, 1934. The stocks were not cut back till September, 1934, and the age of the plants is calculated from that month. The annual girth measurements are accordingly made in September, and the age in 1938 is reckoned as four years.

Table I gives the mean girth measurements in 1936, 1937 and 1938 for the various experimental treatments, and the increments during the year 1937-38. The figures do not include every tree in the field as one row of trees round the periphery has been excluded from the experimental plots. They do, however, include all "supplies" which come within the plots.

Table I also indicates which differences are judged to be significant by the conventional criterion of a 20:1 chance. The only difference which comes into this category is that between the trees growing in the Vigna plots and those growing in con junction with the other covers. This difference was significant in 1937 and persists in 1938. Vigna is the least vigorous of the four covers, and it may be assumed that within the first four years it has a smaller retarding effect due to competition with the trees for food and water than the more vigorous species.

The differences between the increases for the year 1937-38 under the various covers are not significant, but it is interesting to note that the Pueraria plots, which gave the smallest increase for the previous year, now show the biggest increment. This

TABLE I

Budded stumps planted June, 1938.

Girth in inches at 3 feet from union.

| Treatments | 1936 Age 2 years | 1937 Age 3 years | 1938 Age 4 years | Increase 1937-38 |
|---|---|---|---|---|
| *Species of Cover* | | | | |
| 1. *Centrosema pubescens* | 5.16 | 8.93 | 13.40 | 4.47 |
| 2. *Pueraria phaseoloides* | 4.95 | 8.61 | 13.56 | 4.95 |
| 3. *Calopogonium mucunoides* | 5.51 | 9.36 | 13.83 | 4.47 |
| 4. *Dolichos Hosei* (*Vigna*) | 5.43 | 9.66 | 14.49 | 4.83 |
| Mean | 5.26 | 9.14 | 13.82 | 4.68 |
| Standard error | — | 0.19 | 0.18 | — |
| Significant difference (P = .05) | Not significant | 0.64 | 0.61 | Not significant |
| *Timber Treatments* | | | | |
| α Leaving all main stems lying unburned. | 5.38 | 9.38 | 14.06 | 4.68 |
| β Burning all timber on the land | 5.19 | 9.16 | 13.94 | 4.78 |
| γ As β, but also removing and burning all larger lateral roots. | 5.22 | 8.88 | 13.46 | 4.58 |
| Mean | 5.26 | 9.14 | 13.82 | 4.68 |
| Differences | Not significant | | | |
| *Control of Cover* | | | | |
| x Keeping platforms clean weeded | 5.30 | 9.17 | 13.76 | 4.59 |
| y Ring weeding in 6 feet diameter circle | 5.22 | 9.10 | 13.88 | 4.78 |
| **Mean** | **5.26** | **9.14** | **13.82** | **4.68** |
| **Differences** | Not significant | | | |

suggests that the retarding effect of a heavy ground cover, which is a predominant factor in the early years, is now being counterbalanced by the benefits due to that cover. That the ground covers are no longer seriously competitive is also evidenced by the general increase in the rate of growth — 4.68 inches for 1937-38 as compared with 3.88 for 1936-37 — and the slight tendency for the trees which are only ring weeded to gain on those planted on clean weeded platforms.

These observations would be incomplete without stating that the cover has been taken back from the platforms in the Y sub-plots twice a year at the times of manuring. At one six-monthly application the cover has been mulched on the surface while at the other it has been forked into the platform. Had this additional control not been exercised it is possible that the trees on the clean weeded platforms would have shown superior growth to those which are only ring weeded.

A distinction must also be drawn between areas in which a heavy cover exists at the time of felling and those in which the cover is planted subsequently. In the former event the cover will need more rigorous control than in the latter.

The results of the timber treatments remain inconclusive. Owing to the small number of replications the experimental error is high, and it is possible that were the comparison a more accurate one the indication of poorer growth in the areas where the lateral roots have been removed might receive statistical support.

Altogether three cases of root disease (*Fomes lignosus*) have occurred in this clearing, all in plots where the lateral roots were left in the ground. This incidence, however, hardly warrants an interpretation in favour of root removal.

The girth figures for the three clones are given in Table II. The comparison cannot be interpreted statistically as there is no replication. Glenshiel 1 is growing in the least favoured portion of the field, but even so is thought to be less vigorous than the other clones under local conditions.

Apart from the experimental data, interesting general information on growth can be derived from this clearing. The figure reproduced as page 89 is a histogram illustrating the frequency distribution of the trees in 1938. For this purpose every tree in the clearing has been included. They have been divided into

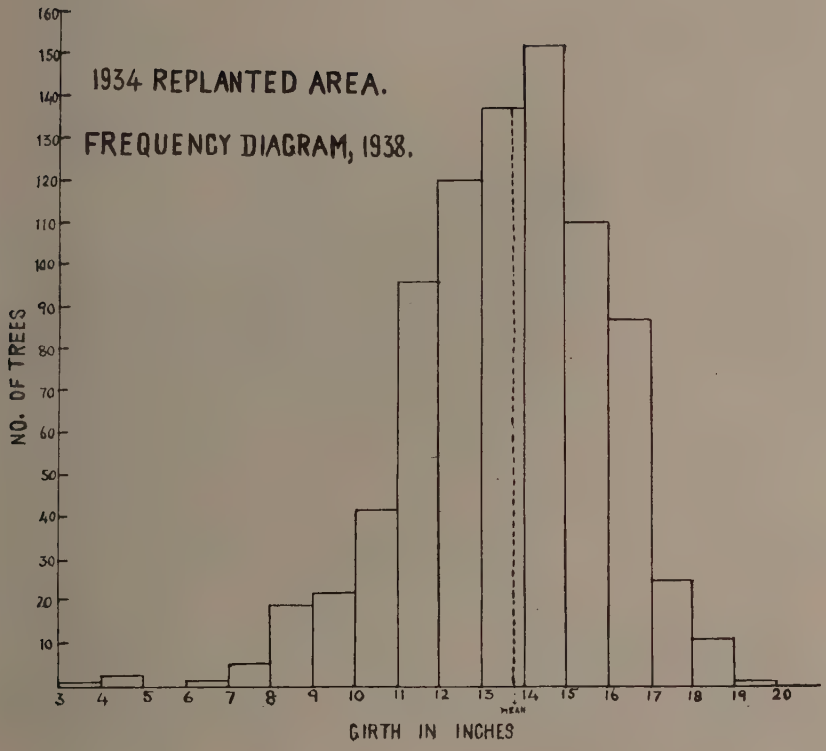
1934 REPLANTED AREA.
FREQUENCY DIAGRAM, 1938.
NO. OF TREES
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
MEAN
GIRTH IN INCHES

TABLE II

Budded stumps planted June, 1938.
Girth in inches at 3 feet from union.

| Clone | 1936 | 1937 | 1938 | Increase 1937-38 |
|---|---|---|---|---|
| Glenshiel 1 | 5.09 | 8.54 | 13.04 | 4.50 |
| A. V. R. O. S. 256 | 5.63 | 10.00 | 14.57 | 4.57 |
| Prang Besar 25 | 5.05 | 8.88 | 13.85 | 4.97 |
| Mean | 5.26 | 9.14 | 13·8 | 4.68 |

classes according to girth and the heights of the columns represent the numbers of trees in the respective classes. It will be observed that the girth varies from between 3 and 4 inches to between 19 and 20 inches. The very small trees are mostly either on the margin of the field, where they suffer from competition with adjacent forest or Rubber trees, or later "supplies."

It is interesting to make a rough estimate of the percentage of trees which will be tappable, judged by the criterion of a girth of 20 inches, at six years old. On the assumption that the rate of girth increment for the next two years will be 4.5 inches per annum, *i.e.*, slightly less than the mean figure for 1937-38, all trees with a girth in 1938 of 11 inches and over will become tappable by September, 1940. The number of trees in this category amounts to about 89 per cent. About 10 per cent of the trees will qualify for special assessment in 1939 in the fifth year of age.

## No. 2 REPLANTING EXPERIMENT, 1935 CLEARING, 13 ACRES.

For various reasons this experiment has been considered unsatisfactory and has been re-commenced. The area was replanted with budded stumps in May-June, 1938, and a further block of 6 acres included in order to increase the number of replications to six.

Before uprooting the former plants girth measurements were made in April and the results are given in Table III. With only three effective replications the experiment is insufficiently

precise to show up small differences, but there is a fairly strong indication of a response to phosphoric acid.

TABLE III

Girth in inches at 3 feet from union.

| Treatment | $N_1$ | $N_2$ | $N_1P$ | $N_2P$ | $N_1K$ | $N_2K$ | $N_1PK$ | $N_2PK$ | O | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| July, 1937 | 4.34 | 4.81 | 4.92 | 5.04 | 5.01 | 5.33 | 4.84 | 5.22 | 4.97 | 4.94 |
| April, 1938 | 5.64 | 6.44 | 6.92 | 7.11 | 6.94 | 6.88 | 6.73 | 7.14 | 6.50 | 6.70 |
| Increase 1937-38 | 1.30 | 1.63 | 2.00 | 2.07 | 1.93 | 1.55 | 1.89 | 1.92 | 1.53 | 1.76 |

## No. 3 REPLANTING EXPERIMENT, 1936 CLEARING, 10 ACRES.

The area is approximately 10 acres in extent and is divided into four main blocks each of which has been planted with a different clone. The clones are A.V.R.O.S. 49, Prang Besar 25, Sungei Reko 9 and Rubana 393. Each block is divided into 3 sub-blocks for comparing 3 methods of opening, viz. contour trenches, contour platforms and contour pitted drains. Each sub-block is further divided into 3 plots, which are planted in three different systems:—

A. Planting budded stumps.

B. Planting stumped buddings.

C. Seed at stake for budding in the field.

Finally, each plot is divided into 2 sub-plots for comparing organic and inorganic fertilisers. A sub-plot, which is the smallest unit in the layout, consists of a group of 12 plants.

The stumped buddings and budded stumps were planted at the end of May, 1936, and the seed in September of that year. Growth of the seedlings was not very satisfactory and by the end of 1937 it had only been possible to obtain a successful budding in 76 per cent of the holes. The remainder were budded in March-April, 1938.

Measurements were made in June, 1938, of girth in the case of the budded stumps and stumped buddings, and of height in the case of the plants budded in the field, and the figures are given in Table IV.

TABLE IV

| Treatments | A. Budded stumps | B. Stumped buddings | | C. Budgrafts from seed at stake |
|---|---|---|---|---|
| | Mean girth in inches June, 1938 | Mean girth in inches June, 1938 | Increase 1937-38 | Mean height in feet June, 1938. |
| 1. Contour trenches | 6.57 | 8.57 | 3.28 | 6.36 |
| 2. Contour platforms | 6.34 | 8.88 | 3.52 | 6.92 |
| 3. Pitted drains | 5.71 | 8.22 | 3.22 | 4.45 |
| Mean | 6.21 | 8.56 | 3.34 | 5.91 |
| Differences | Not significant | | | |

*Methods of Planting.*—As is to be expected at this stage the stumped buddings are substantially bigger than the budded stumps, the difference between the means of all treatments being 2.35 inches, and it remains to be seen whether the advantage will be maintained. For the stumped buddings it is possible to give the increases in girth during the year 1937-38, and the mean figure of 3.34 inches, may be taken as showing satisfactory development. 6.21 inches for the mean girth of the budded stumps at two years old is also very satisfactory.

The field buddings can hardly as yet be compared with the other methods of planting. The measurements were made at a time when some of the buds had not yet sprouted and therefore had to be given a 'nil' value. The average height for those plants successfully budded in 1937 and cut back in December was 7.48 feet.

*Methods of Opening.*—Owing to the fact that the measurements are not in the same units for all methods of planting it has not been possible to make a combined analysis. Taking each method of planting separately, the differences between the methods of opening are in no case found to be significant by the

conventional 20:1 standard, though in the case of treatments A and C they are nearly so. If, however, the figures for budded stumps and stumped buddings are combined, as may legitimately be done, a significant treatment response is shown. This is due to a reduction in error presumably owing to the doubling of the plot size. The figures are given in Table V and it will be seen that whereas there is no difference between the trenches and platforms both are significantly better than the drains.

TABLE V

| Treatment | Budded stumps and stumped buddings Mean girth in inches, June, 1938. |
|---|---|
| 1. Contour trenches | 7.57 |
| 2. Contour platforms | 7.61 |
| 3. Pitted drains | 6.97 |
| Mean | 7.38 |
| Standard error | 0.146 |
| Significant difference | 0.504 |

At first sight it is surprising that there is not a significant treatment difference in the case of the plants budded in the field (treatment C), as the figure for contour platforms is more than 50 per cent greater than that for pitted drains. The explanation is to be found in the fact that some of the buds had not yet sprouted and had to be given a 'nil' value. This is tantamount to a partial failure of some of the plots, most of these plots occurring in the pitted drain areas. In such circumstances the estimate of error derived from the combined analysis of variance is not really applicable to any of the treatment comparisons. This, of course, is only a temporary disability. A fairer statement of the comparison is that in the platform and trench areas the proportion of successfully budded seedlings at the end of 1937 was in each case 84 per cent, whereas in the pitted drain areas it was only 61 per cent.

Taking a general view of these figures, there can be no doubt that in this clearing the growth in the trenches and on the platforms has been better than where there are level silt pitted drains between the contour rows. Two possible reasons are;—

(1). Competition with a heavy ground cover is more acute where there are no earthworks in close proximity to the plant, although similar control measures have been taken in each case.

(2). In the case of the trenches and platforms the rainfall is trapped close to the young plants, probably resulting in accumulation of soluble plant foods within range of their roots, whereas the pitted drains hold the water at the maximum distance away.

The inferior growth in the first two years should not be taken to condemn the system of silt pitted drains, either level or slightly graded. In two years the story is by no means fully told, and the fact that this system is initially considerably cheaper must be borne in mind. Moreover the platform system has been found elsewhere to develop objectionable features in later years, while the trench method, although considered to have various advantages, has not yet stood the test of time.

*Organic v. Inorganic Manuring.*—The figures for the organic and inorganic sub-plots are given in Table VI. The difference is in no case significant.

The total expenditure on fertilisers up to June, 1938, amounted to Rs. 18 per acre for the organic plots and Rs. 11 for the inorganic. Up to the present, therefore, the use of inorganic fertilisers has proved the better economic proposition.

The fertilisers used are:—

*Organic*

Blood Meal
Bone Meal
Groundnut Cake
Muriate of Potash

*Inorganic*

Calcium Cyanamide
or
Sulphate of Ammonia
Safaga Phosphate
Muriate of Potash

TABLE VI

| Treatments | A. Budded stumps | B. Stumped buddings | | C. Budgrafts from seed at stake |
|---|---|---|---|---|
| | Girth in inches June, 1938. | Girth in inches June, 1938 | Increase 1937-38 | Height in feet June, 1938 |
| Organic | 6.28 | 8.60 | 3.41 | 5.55 |
| Inorganic | 6.13 | 8.50 | 3.26 | 6.27 |
| Mean | 6.21 | 8.56 | 3.34 | 5.91 |
| Differences | Not significant | | | |

# PRACTICAL COMPOST MAKING ON ESTATES.*

H. W. STARLING

## TRANSPORT

ALL ravines and boundaries should be planted with wild sunflower (*Tithonia diversifolia*), and edges of small streams with Vattikanny (*Macaranga* spp.). This latter tree should be left unlopped in dry months as it provides shade along the edge of streams and is therefore a preventive against the malaria mosquito breeding. The sunflower planted in the ravines and boundaries should be cut and transported by labourers returning from work, whilst the Vattikanny, being planted in the streams, near the lines, should be transported by labourers on their way to work, either to the nearest cart road or to the central depôt for the making of compost. Labourers are liable to grumble at this "extra" work to begin with, but very soon get to look on it as a normal routine.

Jungle should be treated in the same way, making the labourers carry this in the evening, either to the central depôt where the cattle shed is or straight to the field in which the compost is to be put. I will deal with making compost in the field later on, as this is again a way in which considerable transport can be saved, it being cheaper to transport the small quantity of cowdung and urine, or urine earth, than to transport the green material to the shed, and then again transport the finished compost back to the field.

All line sweepings can be treated in the same way by making the sweepers carry them to the nearest cart road or to the nearest cattle shed.

Added to this, a lot of transport can be saved by checking up lorries and cutting the jungle, etc., so that they can pick the bundles up when they are otherwise running empty.

* The Rubber Research Board welcomes papers on subjects of general interest from outside contributors but does not accept any responsibility for the views expressed therein.

Weeding contractors should be provided with sacks to enable them to bring all their weeds to a central depôt, where they should be weighed up by a Weeding K.P. each evening. If there are too many weeds each contractor can bring a rice bag full to the depôt and leave the balance to be collected by the estate. If each contractor's weeds are weighed every evening it prevents labourers throwing them into the jungle and ravines, to save themselves the trouble of carrying them. Most people will be surprised at the amount of weeds that can be collected off an estate, some of course, more than others. Great care should be taken to see that as little earth as possible is left on the roots of the weeds, as when the compost is finished it will be found that the vegetable matter has decreased by more than 50 per cent whereas the earth has not.

Often the judicious use of wire-shoots can save a considerable amount of transport either in shooting the bundles of jungle loppings, etc., to the central depôt, or by shooting the dung in bags to the field.

## MATERIAL

All material, especially the coarser material should be crushed; this can be done by laying it along the wheel tracks on the cart road, and letting the lorry or carts do the crushing, or by putting in the cattle sheds so that the cattle trample it. If this is not done, it will be found that the compost is uneven, the fleshy softer parts being rotted, whilst the ribs, stalks and coarser materials are only starting to decompose, thereby, metaphorically, giving the compost indigestion, in that after 60 days, when the softer parts should be storing nitrogen, the coarser parts will still be taking nitrogen to break them down.

*All material must be obtained from outside the cultivated area except in the case of weeds brought in by contractors.*

Outside material available on the majority of the estates is as follows:—

*Surrounding jungle and manna.*—Manna grass (*Andropogon nardus*) does not come back readily after cutting, and it is better to plant all boundaries up with wild sunflower, which is excellent for the making of compost, and can be very easily grown from cuttings, provided they are not put in a swampy place. In most patna boundaries Vattikanny can also be planted as it is a quick growing tree and the leaves readily

decompose. This can be grown from cuttings, but most jungles have plently of plants which are more easily established. Manna grass needs crushing as it has thick ribs to the leaves, and stalks to the flowering stems. Even the finer manna grass needs crushing, as here again there are hard stalks.

Most jungles, owing to the unevenness of the textures of the different leaves, needs crushing or trampling, but it will be found that on the second cutting of the jungle, the stems are far more fleshy than the original cut. Succulent weeds, yams, etc. do not need crushing. Line sweepings generally do not need any addition of lime nor ashes, as there are plenty of ashes already here from the labourers' fires.

All material should be well mixed when making the first charge; this is most essential to establish the aerobic conditions necessary for the correct and quick making of compost; *e.g.*, a heap made of succulent weeds will get over damp, shrink down into a compact unaerated mass, whilst a heap made of manna grass only will be very liable to dry out, both of which stop the organisms from functioning, with the result that the decomposing is delayed.

*Ashes.*—Only wood ashes should be used. Coal ashes are detrimental to the making of compost. If there is a shortage of ash, unslaked lime may be added in the proportion of 10 lbs. ash to 15 lbs. of lime per ton.

*Cattle Sheds.*—Villagers are only too ready to loan their cattle and buffaloes to the estate, to save themselves the trouble of looking after them, but adequate feed must, if necessary, be planted for them. Paspalum, along drain and road edges is good, and is also a prevention to soil erosion; and Mauritius grass (*Panicum barbinode*) in swampy places:—

Cattle sheds can be used in various ways:—

(1) With concrete floors and a drain to take away the urine to a pit outside; the dung should be swept up each day, and kept under cover until wanted.

(2) If money is not available for these expensive sheds, an ordinary earth floor will do; dung should be swept up each day, and once every week or 10 days about 2 inches of the floor earth should be taken up and kept under cover until wanted (this earth is called urine earth), then fresh earth should be laid. Dung should also be kept under cover until wanted.

(3) An earth floor covered with 6 inches of straw, dry weeds, dry jungle, or manna grass. Cattle to be allowed to stand on and trample this for about 3 days, when another layer is laid, a fresh layer being added about every 3 days, until the dung is wanted. It is better not to leave this for more than approximately a fortnight as heat starts to generate to the discomfort of the cattle.

By this way the quantity of the activator is increased as the vegetable matter gets saturated with urine and the dung gets well mixed and trampled into the vegetable matter. It also obviates any further crushing being necessary, if the material is coarse, as it is being crushed by the cattle the whole time.

(4) In Rubber, another way especially with buffaloes, is, to build a barbed wire corral in the place where the compost is to be put out, fill it up as mentioned in No. 3 and let the buffaloes do the necessary. By this method a considerable amount of transport is saved, as these corrals can be put on the edge of the jungle, which is far from the cart road, and can be very easily moved from place to place as required.

It is better and quicker, if possible, to concentrate as many cattle as possible in one shed, as it is easier for supervision. The vegetable matter is made ready more rapidly, and the more dung incorporated per ton, the better.

*Depôts.*—The ideal method of making compost is to take the material as mentioned in No. 3 direct from the cattle shed and make it into a heap, adding about 20 lbs. of ashes per ton, mixing it in thoroughly. Some water may be necessary, but very little. This should all be done under a covered shed; turning of this and finally storing of the finished compost for a month should all be carried out under sheds. Naturally this is too expensive for a normal estate in these times.

Apart from the expense, the material from the cattle shed, can be used as an activator for about four times its own weight, thereby getting more value from the cattle by making more compost.

## MAKING COMPOST

Making compost in the open is the most economical way and quite satisfactory provided various precautions are taken.

(1). See that the correct degree of dampness, *not* sogginess is maintained by watering when making and turning. If very dry weather is experienced it might be necessary to water between turns. The correct degree of dampness is equal to that of a squeezed sponge.

(2). By thatching with either manna or illuk grass (*Imperata arundinacea*); this is the best, or by cadjans, not so satisfactory, but the best one can do in the low-country. This thatching is a preventive against driving wind, either wet or dry, both being bad.

(3). If heaps are built on a hillside, a small drain should be cut on the top side and, if on the flat, all round to prevent water flooding the bottom of the heap and making it soggy.

The manna or illuk thatching can be used in making fresh compost, when the heap that it has covered has been taken to the field. It will be found that by this time it will be partly rotted, and will very easily make up into compost. The leafy part of the cadjans can also be used like this, but is all the better for some crushing first.

In a dry climate pits can be used and very good results obtained, but in rainy districts it is advisable not to use them, unless the pits are thoroughly drained.

Another drawback to pits is that they have to be in a central place and this increases the cost of transport. I will deal more fully with pits later.

To make up the heap in the open, either at the central depôt or in the field the method is as follows:—

Make a heap 6 feet broad and as long as space and material permit, but it is better to make it 10 feet long to start with and then add on 10 feet lengths until all the material and dung are heaped.

A heap 6 feet broad by 10 feet long, (by the height I will describe later), will give just under 200 cubic feet of withered material and dung, which is approximately equivalent to 1 ton finished compost, which is equal to about 70 to 80 cubic feet.

Spread a thin layer of activator or dung, about 1 inch to 2 inches thick, 6 feet × 10 feet; on top of this put about 6 inches of withered material; spread 3 lbs. of dry wood ash on this,

and water. It will need about 8 to 10 gallons of water per layer if the material is withered. Watering is best done by a hose or a watering can *with* a rose. On top of this put a layer of about 2 inches to 3 inches of activator or dung.

Continue these layers until a heap $2\frac{1}{2}$ feet high has been made. Then continue the layers in the same way, but sloping the two sides off in the shape of a roof until a height of 4 feet in the centre of the heap is obtained. (See diagram I).

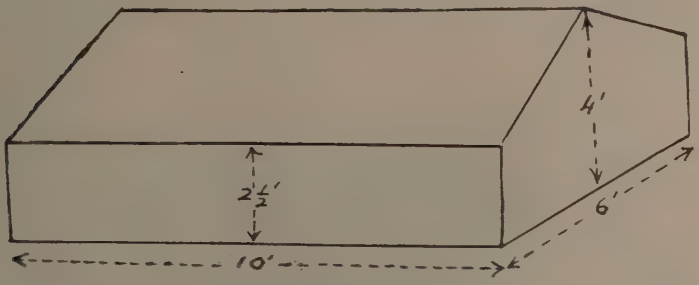


DIAGRAM I

If using dry urine earth, mix this with the ashes and put them on at the same time, in the proportion of $1\frac{1}{2}$ lbs. of urine earth to $1\frac{1}{2}$ lbs. of ash.

The first 10 feet or 1 ton is now completed, and another 10 feet may be joined on, continuing this for as long as the material and space allows.

On no account must the labourers walk on the heap or press it with their hands, to make it look pretty. This will tend to make the material matted and stop aeration and, as the process of turning withered vegetable matter into compost or humus is done by living organisms, it is vitally necessary to ensure good aeration. If pressed down the result will be a soggy, sour mass.

If there is a shortage of water, it will help to alternate the withered material with green juicy material, such as pumpillu (*Ageratum conyzoides*), ammulla, yam leaves, succulent grass, etc. the ash and dung being put between each layer as shown in diagram II. But instead of a 6 inches layer of the green material being used it should be reduced to a layer four inches thick.

If there is a shortage of dung, a good idea is to mix the dung with the water poured on between the layers. This should be about the consistency of pea soup and, of course, cannot be poured with the rose affixed to the watering can. The whole heap should now be thatched.

In two or three days' time the heap will be getting hot and the temperature will continue to rise for approximately the next ten days until a temperature of about 130° to 140°F will be obtained, after this the temperature will gradually fall to about 100°F when the heap is ready for turning; in all about 16 days — (sometimes more and sometimes less) from the charging of the heap.

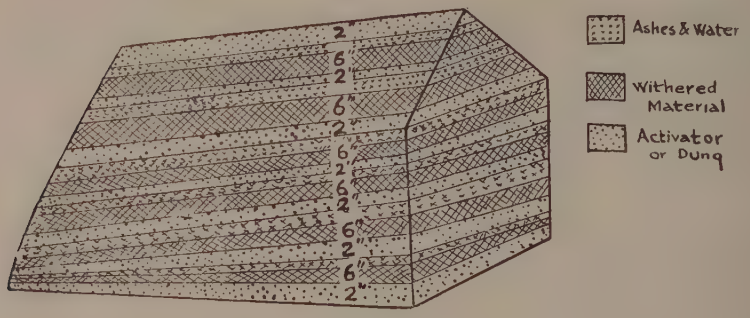


DIAGRAM 11

First of all remove the thatching and lay it carefully aside; then with a two-prong mamoty fork start at one end of the heap and throw the compost back to make a fresh heap, of the same width and height as the first. The heap will not be nearly so long, as in this time it will have shrunk considerably.

Again, on no account must the labourers be allowed to trample the fresh heap or press it down with their hands. Water, if necessary, must be added according to the dryness of the material. When the heap is finished thatch again.

On the first turning of the heap the material should all be covered with whitish fungus; very often near the top and sides white toadstools will appear. The fungus looks as though a mixture of ashes and lime had been thoroughly sprinkled over all the material.

After two or three days the temperature will again start rising to about 110° to 120°F and will continue like this for about 10 days, when it will begin to fall, until after about 21 days it will be approximately 80° to 90°F, and is again ready for turning.

The process is exactly the same as for the first turn, making the heap again the same breadth and height as the original heap. The length will again have shrunk considerably. The material will now have lost nearly all the white fungus, and should be a rich black colour all over and very inclined to crumble. Water might again be needed, but it depends upon the dampness of the material.

Once again the temperature will rise for about 10 days, but only to approximately 100°F when it will start falling, until after 21 days the heap will again be ready for turning.

Exactly the same process as for the previous turns should be carried out, but the length of the heap will now have shrunk to about half the original heap. The colour of the material will be black and it should crumble easily. The heap is now ready for storing and the whole should resemble a fine leaf mould and pass through a No. 6 mesh.

Store this compost for about 1 month for conservation of nitrogen; it can be heaped in a large heap, but the heap *must* be kept covered, not being allowed to dry out nor to get any wetter.

Compost can be kept for longer than 1 month, provided precautions are taken against drying out or getting wet, but the material is in the best condition at the end of the month when nitrogen content is at its highest.

1st to 10th day temperature rises to 140°F.

10th to 16th day temperature falls to approximately 100° 16th day 1st turn.

16th to 26th day temperature rises to approximately 120°.

26th to 37th day temperature falls to approximately 90° 37th day 2nd turn.

37th to 47th day temperature rises to approximately 100°.

47th to 60th day temperature falls to approximately 80° 60th day 3rd turn.

Leave for 30 days, and about the 90th day the compost is ready to be put in the field.

## COSTS

| *Estate A.* | Cost per ton Rs. cts. |
|---|---|
| Cutting of Sunflower ... ... | 17 |
| Cutting of Manna, etc. ... | 95 |
| Making of 1st charge ... ... | 50 |
| 1st turn ... ... ... | 17 |
| 2nd turn ... ... ... | 17 |
| 3rd turn ... ... ... | 17 |
| Transport to field ... ... | 40 |
| Total | 2·53 |

On the above estate the compost was made in the field and all manna and sunflower was carried by the pluckers in the evenings to the site of the compost heap in the field. Weeds were all brought by the contractors. Water was handy and, for a few heaps, was allowed to run down the road drain to the heap.

Dung was carried by the men on their way to work in the morning. Ashes were carried by the labourers making up the heap.

Transport to the field, *i.e.*, spreading, was cheap owing to 7 tons per acre being put out, and also having the heaps made on the roads all over the field.

| *Estate B.* | Cost per ton Rs. cts. |
|---|---|
| Cost of cutting jungle ... ... | 1 51 |
| Cost of making 1st charge ... | 50 |
| 1st turning ... ... ... | 17 |
| 2nd turning ... ... ... | 17 |
| 3rd turning ... ... ... | 17 |
| Transport to field ... ... | 35 |
| Lorry transport ... ... | 06 |
| Cattle keeper ... ... | 05 |
| Total | 2·98 |

On this estate, pluckers and men carried bundles every evening to the field or to the cart roads where lorries, otherwise running empty, picked the bundles up and took them to the field. Weeds were brought to various central depôts on the cart roads, and removed by lorries when running empty.

Dung was obtained from a central shed and transported to the field by lorries; this has been charged for as the lorries were not on their way anywhere travelling empty.

Corrals were erected in the field for buffaloes, and the compost made *in situ*, ashes, etc., being carried by the labourers making the heaps. Water in most cases was easily accessible. Spreading in the field was fairly easy being in Rubber, 5 tons per acre being spread and the lay of the land being on the flat side. Spreading in the field naturally varies in cost according to the lay of the land, tons per acre, etc., and costs very much more if it is being put to supply holes.

## PITS

A useful size of pit is 30 feet long × 14 feet broad by 2 feet deep. It is advisable to have drains leading away from both ends, to enable any excess water to get away. It is also a good idea to have a drain running down the centre of the pit lengthwise, both for draining off water and for aeration. This drain should be covered with very small expanded metal, perforated iron or galvanized iron sheeting, and need only be 1 foot wide by 6 inches deep.

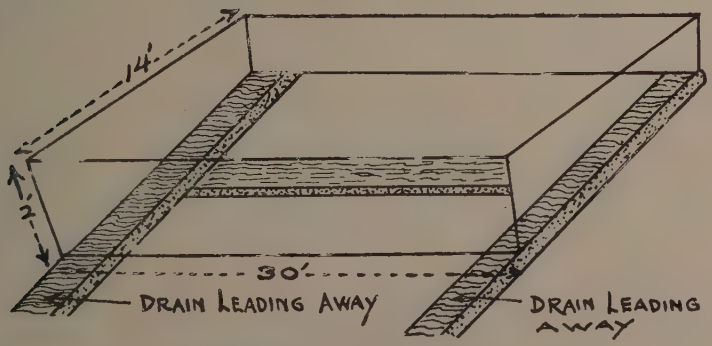


DIAGRAM III

The pit is filled up in layers in the same way as previously mentioned, up to 6 feet above the ground level of the pit, except

that the top is not sloped to the shape of a roof. A slight slope can be given to either end of the pit. Leave 2 feet at the lower end of the pit for space into which the material can be put when the heap is turned.

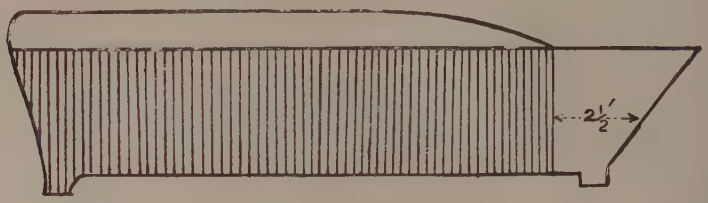


DIAGRAM IV

When the pit is filled, thatching, watering, and times for turning are the same as for making heaps in the field as previously mentioned. After the third turn when the compost is ready for storing, remove it from the pit and store in heaps outside, this leaves the pit vacant for the next charge.

A pit of the above size will approximately be equal to 30 feet × 14 feet × 2½ feet: 1,050 cubic feet: 5½ tons.

The cost of making compost in a pit does not materially differ from making it in the open, with the exception of the initial cost of cutting the pit, transport of material to the pit and transport of the compost to the field; both these latter are liable to increase considerably the cost per ton, as against compost made in the field. Another disadvantage, previously mentioned, is that in a country with heavy rainfall the pit is liable to contain far too much moisture.

## SHEET COMPOSTING

On Rubber estates a very useful idea is to plant all road and drain edges with Paspalam grass, and allow the cattle to feed on this and the Pueraria; on no account must the cattle be allowed to feed on Pueraria, unless there is a thick dense cover. Care must be taken that they do not feed off the same place for more than one day without an interval to allow the cover to grow, as the fodder will be killed off if continually fed on.

For example, in the case of a herd of 20 cows and an estate of 100 acres; it should take the cows between 80 to 100 days

to feed right round the estate, before coming back to the place from where they started, thus giving the fodder about 3 months to regrow.

The best way of doing this is by movable fences, but it is an expensive way. The cattle keeper can easily keep the animals under control in a settled area, provided there is sufficient fodder for them to eat.

The advantages of the above method are:—

(1). The dung and urine having been conserved in the cattle shed overnight, the dung deposited during the day is lost if they are allowed to go to the jungle for their fodder, but if fed in the Rubber their dung and urine falls on the fallen Rubber and Pueraria leaves and helps to turn them into compost on the ground.

(2). Complete saving of transport.

(3). Quicker decomposing of the fallen leaves.

# THE CARE OF YOUNG BUDDED TREES.*

R. K. S. MURRAY,
*BOTANIST AND MYCOLOGIST*

THE subject of my address this morning is the care of young budded trees. If the nature of the advisory correspondence in my files may be taken as an index of topical interest I need offer no apology for tendering advice, some of which may be regarded as rather elementary. The young budded plant does undoubtedly need more nursing than the seedling, and I hope that some of my hints may be of value to those of you who have budded clearings under their care and have no great experience of their upkeep. I do not suppose that the methods of treatment we recommend are in all cases necessarily the only satisfactory, or even the most satisfactory, methods, for in this as in other matters we are continually learning, but they are based on fairly wide experience and observations not only in our own clearings but also on estates.

I am not going to give an account of the budding operation but will start from the time the graft has been declared a success. If the scion is to grow *in situ* it merely remains to cut the stock back to within 3 or 4 inches of the union and to suppress all stock buds until the bud shoot has sprouted. It may seem elementary to urge the importance of ensuring that the shoot which is allowed to grow really comes from the bud patch and not from the stock, but I have seen so many cases of "false buddings" arising from insufficient care at this stage that I feel justified in doing so. From the time there is any sign of fresh growth regular inspections should be carried out at intervals of about 10 days until the bud shoots are well away.

In the case of buddings on very large stocks the treatment recommended is rather different, and I propose to deal with this under the heading of stock snags.

* An address given to the Southern Province Planters' Association on August 27, 1938.

N.B.—The figures referred to in the text are not reproduced but a circular illustrating the methods of pruning trees of Tjirandji 1 is available on application.

## TRANSPLANTING.

If budding is carried out in the nursery the stump has to be transplanted to the field, and there are several possibilities of error in this operation. The commonest and most serious mistake is to damage the root system unnecessarily, either by careless removal from the nursery or by cutting off the lateral roots close to the tap root before planting. It stands to reason, and has been amply demonstrated by experiments and estate experience, that the more the root system has been mutilated the slower will be its recovery from transplanting and the greater, therefore, will be the number of deaths and the slower the growth of those plants which survive. The procedure, which is still all too common, of making a hole in the filled earth with an alavango and planting therein a stump bereft of all lateral roots may have been reasonably satisfactory in the old days of planting ordinary unbudded stumps, but is certainly not to be recommended with budded stumps. The stump should be pulled from the nursery bed with considerable care, having first loosened the soil with a fork, or cut the earth away with an alavango about 1 ft. from the row of plants, and lateral roots should not be cut off within 6 inches of the tap root. The stump will then have to be planted in a fairly large hole excavated with a mamoty rather than being thrust into the ground like a stick. It is important to replace the soil carefully and pack it tightly round the roots. The correct procedure is more expensive but is amply justified as the following recent experience indicates.

On Dartonfield we planted about 2,100 budded stumps at the end of May and early June this year. Despite dry weather for the first half of June we have so far lost only one plant and practically all the rest have sprouted and are showing good growth. On an estate not five miles away a smaller number of budded stumps were planted at the same time but without the same precautions, and the casualties have exceeded 60 per cent. I might mention that in both cases the stumps were watered during the dry weather. I mention these figures, not in a spirit of bravado, but to show that careful work is fully repaid.

Another common source of disappointment is the use of small stumps. For transplanting the stocks should certainly not be less than 1 inch and preferably not less than $1\frac{1}{4}$ inches in diameter at ground level.

The procedure we have found most satisfactory is to ring-bark the stock 6 inches above the bud patch about 10 days before

planting. The bud is then almost ready to sprout when the stump is transplanted, and will usually come away within 3 or 4 weeks, the time varying to some extent with the clone. At the time of transplanting the stock is cut back to within 3 or 4 inches of the bud at an angle of 45° sloping away from the bud, and the cut end dipped in melted grafting wax.

Another precaution which we consider to be justified when transplanting budded stumps is to provide each stump with a protecting basket at a cost of two or three cents. This shades the ground immediately surrounding the stump and can be draped with cover crops to avoid undue loss of water in the event of a dry spell intervening shortly after planting. The basket also protects the young shoot from injury, encourages it to grow upright and at a later stage shades the callus bark growing over the union.

While on the subject of transplanting I might mention a third method of establishing budgrafts in the field viz: planting stumped buddings. With the advantages and disadvantages of this method I am not at the moment concerned, but the use of such material is at least a valuable means of supplying vacancies up to the third year of age and I will therefore describe the method which we have found most satisfactory. The scion is allowed to grow in the nursery, plants being spaced at least 18 inches apart. When the bark is fully brown at a height of 8 feet the plant is ready to be stumped. It should be cut at about this height in the middle of an internode, and transplanted either immediately or preferably after a few days when the buds are beginning to swell. Two or three branches should be allowed to develop at well spaced intervals unless the stem dies back to the level of the subsequent tapping panel, in which case only one shoot must be left. It will be found that during the first year little new growth will take place, but during the second year the girth increment should be up to the normal figure of 3 to 4 inches.

## TREATMENT OF STOCK SNAGS.

Returning to plants budded in the field or transplanted as budded stumps, we have to consider what to do with the 3 or 4 inches of stock left as a snag. Where the diameter of the stock does not exceed about $1\frac{1}{2}$ inches, *i.e.*, for stocks of normal size and age, we consider it satisfactory to allow the snag to decay and fall off without further treatment. In the case of larger

stocks, however, the snag should be cut off when the bud shoot has formed about 18 inches of brown wood. The cut should be made at an angle of 45°, care being taken that no "shelf" is left protruding above the point of junction of stock and scion. Indeed it is advisable for the top of the cut to be a small fraction of an inch below this point. The correct position is shown in Fig. 1.

If the surface thus exposed is not more than about 2 inches across it is unnecessary to apply any wood preservative as the union will heal so rapidly, provided the plant is growing well, that the risk of infection by wood rotting fungi is unimportant. If, however, the surface is larger it should first be painted with a water miscible disinfectant such as 5 per cent Izal or 10 per cent Brunolinum Plantarium, and on the following day given a protective covering. The best type of covering has been the subject of various trials, and we still do not know a suitable cheap substance which will protect the exposed wood surface from fungal invasion without retarding the growth of callus. Treatment with such a dressing as Skene's pruning mixture is satisfactory provided the union is shaded until it has completely healed over. Care must be taken, however, that it is applied only to the wood and not to the surrounding cortex. The disadvantage of any black dressing is that it absorbs a great deal of heat if directly exposed to the sun, and thus retards the growth of the callus bark. It is important, therefore, either to keep the exposed surface white with paint or whitewash or to provide shade. This can be done with a protecting basket or by growing a screen of shrubby green manure plants close to the budding.

Experiments carried out by the Rubber Research Institute of Malaya have shown that the growth of the callus is expedited by the application of a mixture of cowdung and earth in the proportion 1:3. This should be smeared over the cut end in a layer about $\frac{1}{4}$ inch thick and covered with a piece of sacking tied in position. In our experience, however, the wood of very large stocks is liable to rot rather badly under this treatment, and if seedlings with a diameter of more than 4 inches are budded it would probably be best to combine the cowdung earth application with a smear of a waterproof fungicide underneath. Such unions should be examined at least every six months and the dressings renewed when necessary. Any rotten wood should be scooped out, and if this leaves a cavity in which

water would settle it should be filled with a plastic wound dressing consisting of a mixture of Colas and coir dust in the proportion $1\frac{1}{2}$:2.

This brings me back to the procedure when very large stocks — say four years old or more — have been budded. Rotting of the exposed portion of the stock after the final pruning is liable in such cases to be rather serious for it is a matter of years before the union has completely healed. In such cases we recommend that the stock snag be kept alive until the scion is about 18 months old, by which time the leaf area, which may be regarded as an index of the tree's food manufacture, will be sufficient to promote speedy growth of the callus bark. This is done by ring barking the stock from 6-12 inches above the bud and cutting it at a height of about 4 ft. One or two shoots are allowed to grow from the stock to keep it alive until the final cut is made. It is particularly important when dealing with large stocks to ensure that this final cut is made at an angle of at least 45°.

## LATERAL BRANCHES.

Buddings have a greater tendency than seedlings to develop lateral branches at a low height, some clones being particularly precocious in this respect. One of the commonest mistakes in the earlier days of budding was to allow low lateral shoots to develop, with the result that it is now not uncommon to see trees which branch in the zone of the tapping panel. We recommend that all side shoots should be pinched off as soon as they appear up to a height of about 7 feet, *i.e.*, as high as a man can reach with a knife. The only exception is in the case of what are sometimes called "runts." If the terminal bud shows no signs of renewed growth but the lateral buds are sprouting, the uppermost lateral may be allowed to take over the function of the terminal and become the leading shoot.

The subject of branching brings me to some notes on the special treatment of two clones which have been widely used for replanting, viz. B.D.5 and Tjirandji 1.

## TREATMENT OF B. D. 5.

The young buddings of this clone show very vigorous growth in the first 18-24 months, but during the next two or three years the girth increment is often slow on account of the delay in the formation of a crown. The typical habit of this clone is to grow straight up without any branching until at the age of 2-3

years the trees shed all their leaves during a spell of dry weather. A large number of buds then sprout all the way down the stem and form branches which never develop more than one growth stage. Until normal branch development takes place the growth is almost at a standstill.

This unsatisfactory feature can be overcome by pruning in order artificially to stimulate the production of a crown. Any plants which have not branched satisfactorily at an age of about 18 months should be pruned in brown wood at a height of about 8 feet. The cut should be made immediately above a bud between two nodes, and two or three shoots allowed to develop at well spaced intervals as shown in Fig. 2. The slight set-back consequent on this treatment will be more than balanced by the enhanced growth during the succeeding years. It is probable that "thumb-nail" pruning of the terminal bud at an earlier stage would achieve the same result, but we have not experimented with this method.

Some such treatment as the above should be a standard procedure for plants not only of B.D.5 but of any other clone which displays a tendency towards delayed branching.

## TJIRANDJI 1 AND WIND DAMAGE.

The special treatment for Tjirandji 1 which I want to discuss relates to the susceptibility of trees of this clone to mechanical damage in wind storms. Such damage is due principally to the following characters:—

(1). Brittleness of the wood probably related to the very rapid growth. To circumvent this one can only suggest that the clone should not be used in low-lying areas of very fertile soil, and that the rate of development in the early years should not be over-stimulated by too heavy fertiliser applications. Tjirandji 1 is a clone which, by virtue of its exceptionally vigorous growth, is particularly suitable for rather poor soil. Where the growth is relatively slow the mechanical strength of the wood is increased.

(2). The normal branching habit is such that weak junctions of heavy lateral branches with the trunk are of common occurrence. In the typical tree the first branch becomes dominant and grows almost as big as the main stem as shown in Fig. 3. The angle of junction is so acute that satisfactory union of the woody tissues is prevented by the inclusion of a layer of corky tissue. This is illustrated in Fig. 4. This main branch

develops secondary branches until the weight of the crown is very considerable: comes a heavy wind accompanied by rain which increases the weight of the foliage, and the branch splits off at the junction. This form of damage is particularly common in the 5th-8th years of age and, in our experience, is most to be feared in hollows and folds in the ground which seem to form "wind funnels."

Although we have not ourselves had the opportunity of putting the matter to the test, it seems that the damage can largely be obviated by removal of this strong lateral branch as shown in Fig. 5. This should be done during the third year of age as soon as it is clear on which trees the branch will assume a dominant rôle. The lateral branches then become disposed about the leader and weak crutches are eliminated.

For older trees, in which no early control of branching has been carried out, it is still possible to reduce the danger by judicious pruning of strong branches. This must be done gradually, as illustrated in Fig. 6, the principle being to allow gaps to be filled in by growth from the unpruned branches before proceeding with the next stage.

(3). This brings me to the third cause of damage. A dense stand of trees of this clone forms a complete closed canopy over which strong winds seem to pass without doing any injury. When, however, for any reason there is a gap in the foliage, or where the edge of a monoclone block is unprotected, the wind penetrates the gap and may create considerable havoc among the branches.

I have recently seen a good example of this. In a 6-7 year old clearing which had not previously suffered much damage, the superintendent with the best possible intentions removed all the dominant branches in one operation, thus creating numerous gaps where before there was a complete canopy. When the S. W. Monsoon storms came in June the damage was fairly extensive despite the fact that the main point of weakness had been eliminated.

With this clone we recommend an initial planting density of 140-150 trees per acre, but when thinning out has to be done the trees should be removed piecemeal rather than in one operation, the object being to allow the gaps caused by the removal of lateral branches to be closed over by the surrounding trees before proceeding with the next stage. During the process, of course, the trees can be tapped.

For these notes on the treatment of trees of Tjirandji 1 I have drawn freely on information supplied by the Rubber Research Institute of Malaya, and am grateful for their permission to do so.

## MANURING

I am going to conclude this address with some observations on manuring young budded trees, my remarks applying to replanted clearings. Perhaps this subject does not strictly come within the scope of the title, but I wish to include it largely because I think there is a certain amount of wasted — or shall I say misdirected — expenditure on replanted clearings at the present time.

When replanting was first under general contemplation some three years ago we expressed the conviction that on the great majority of Ceylon soils the use of artificial fertilisers would be a *sine qua non* of successful replanting. We have no reason to modify this opinion, but on some estates the use of fertilisers is, in my opinion, being overdone. For example, I frequently hear of applications of artificial manure as large as 2 lbs. per plant being applied to seedlings and transplanted budded stumps in their first few months of growth. Again, I have sometimes come across continued monthly applications of 4 oz. being applied to plants of this age. Although admittedly we have a lot to learn about the nutritional demands of young plants for optimum growth, it is almost certain that such quantities are excessive and wasteful. The mixtures used are generally fairly high in nitrogen which, being a somewhat fugitive element, is easily lost if not absorbed by the plant or the cover crop. Moreover, not only is it wasteful to supply nutrients in excess of the plants' normal requirements, but in the case of certain clones it may be harmful to over-stimulate their growth on account of the danger of subsequent wind damage.

Since the expenditure on fertilisers amounts to something of the order of 25 per cent of the total cost of replanting up to the stage of tapping, it is clear that there is scope for substantial economies by supplying food to the young trees only in the most efficient form and manner. This is where research plays an important rôle. I am afraid we are still far from being able to prescribe the correct quantity and form of manure for every type of soil, but we are rapidly acquiring knowledge from field experiments and estate experience in this and other countries.

Recent investigations have, in particular, brought two matters to light:—

(1). The important rôle played by phosphoric acid in the nutrition of the immature tree. This is no new discovery, but it has been emphasised in some striking experiments in Malaya and we have had similar indications at Dartonfield. It is probable that on most soils the fertiliser mixtures for the first few years should be high in phosphoric acid, medium in nitrogen and low in potash. For our normal acid lateritic soils in regions of high rainfall the insoluble rock phosphates are probably the most satisfactory as well as being the cheapest source, but owing to the importance of this nutrient it is wise in our present state of knowledge to supply it in more than one form.

(2). Experiments in both Ceylon and Malaya are showing that there is apparently no advantage in using the expensive organic over the cheaper inorganic fertilisers. The use of the former, therefore, cannot be justified except in small quantities as "conditioners." These remarks do not apply to bulk manure such as cowdung and compost which come into rather a different category.

It is fortunate that both these findings lead to a reduction in the expenditure on manuring, for the inorganic forms of phosphate are amongst the cheapest fertilisers on the market.

I do not intend to deal with the subjects of manner and time of application, except to say that "little and often" is a good guiding principle when feeding young trees, and that the correct area over which to apply the manure can easily be determined by careful excavation of the root system of a few sample plants. We have prepared a schedule of standard recommendations for the guidance of estates. It is most unlikely that the procedure outlined therein is economically ideal even for one particular type of soil, but it is based on the information that is so far available and has at least the virtue that it is giving satisfactory results in practice.

# CONFERENCE ON NEW PLANTING ON RESERVE JUNGLE LAND (MALAYA)

## FURTHER NOTES ON "BURNING," "COVERS" AND "MANURING,"*

IN the general Recommendations for the Development of Jungle Reserve Land for New Planting with Rubber, (Paper No. 1) the main departures from earlier customs and practices are concerned with "Burning," "Covers," and "Manuring," and these operations are discussed in more detail in the following paragraphs.

### BURNING

In most tropical lands burning has been invariably used for removing jungle débris and trash prior to planting agricultural crops, and where annual or close-growing crops are concerned there is probably no better alternative procedure.

Where Rubber trees (or similar long-term crops, planted with comparatively wide spacing) are to be grown, other aspects of the subject need to be considered.

Complete clean-clearing of the soil is not important at the start because the young plants, for several years, use only a small proportion of the land to which they are allotted; a light burn and the retention of as much forest trash as will permit normal supervision of, and movement through, the area, carry several advantages over normal burning, which are listed below.

(1). *Soil Protection.*—Malayan rainfall is often very intensive and full protection against soil erosion is required on newly felled land as quickly as possible. Similarly, unduly prolonged

* Paper by C. G. Akhurst, Rubber Research Institute (Malaya) at the Fourteenth Annual Conference of the Incorporated Society of Planters, Kuala Lumpur, held on September 23-25, 1938 at Penang.

exposure of a bare soil to the sun is bad. Both these effects are minimised by the retention of timber and débris, and rapid establishment of covers.

(2). *Organic Matter.*—Most of the unburned plant material, sooner or later, forms organic matter or humic material in the soil and, in spite of the slow rate of decomposition of those plant portions which have low nitrogen contents, the comparatively low humus-status of Malayan soils in general makes it extremely desirable to retain this plant material.

(3). *Soil Burning.*—Whilst the dangers from soil burning are liable to be rather over-emphasized, the light burn or "scorch" reduces these to a minimum. On peat soils there is a great danger of doing permanent harm to the soil by heavy burning, and for these soils only a light burn should be employed when clearing jungle.

(4). *Loss of Minerals and Nitrogen.*—Much of the nitrogen content of the plant-débris is lost during burning, and in heavy burns considerable loss of the more volatile mineral plant foods may occur, *e.g.*, phosphate and potash. In any case, the ash material containing immediately available plant-foods, which is returned to the soil, tends to be concentrated in spots or patches, so that the newly planted Rubber may not reach it for several years, by which time part of the plant foods may be immobilised in the soil or leached out.

Whilst no figures can be quoted which give the quantities of plant foods contained in jungle trees, the following figures taken from an analysis of a single rubber tree are of considerable interest. Dr. A. W. J. Dyck is preparing a full discussion of the complete analyses for publication in the Journal of the Institute.

The total weight of the tree was about 5 tons, of which one third was water, and the leaves alone amounted to over 3 cwt. The analysis of leaves and stalks together gave the following figures:—

| | lb. |
|---|---|
| Nitrogen ... ... | 4.2 |
| Phosphoric acid ($P_2O_5$) ... | 0.6 |
| Potash ($K_2O$) ... ... | 1.9 |
| Calcium oxide ... ... | 3.2 |
| Magnesium oxide ... ... | 2.2 |

Weights of different parts of the tree:—

| | lb. |
|---|---|
| Leaves and stalks ... ... | 423 |
| Twigs ... ... | 650 |
| Small and side branches ... | 1,867 |
| Main branches ... ... | 3.657 |
| Main stem ... ... | 3,338 |
| Roots ... ... | 1,764 |
| Total | 11,699 |

Jungle trees and debris will not necessarily have a similar composition, but their plant food contents will be of a similar order, and thus nitrogen losses through burning will be heavy. An uneven distribution in the soil of the large amount of minerals in the ash is obviously undesirable, and is least likely under conditions of light burns.

## COVERS

The value of covers to the soil, under Malayan conditions, lies in many directions but for the matters under discussion, their effects on young Rubber plants during the first year or two of growth will be considered.

In a new clearing, whilst an excessively heavy and uncontrolled growth will check the Rubber, a good growth of controlled covers is essential as quickly as possible in order to help shade the soil and prevent soil wash. Further, the more rapidly covers are established, the sooner will be available plant material for surface soil mulching.

Leguminous covers, if planted in new clearings, will establish fairly quickly, in 3 to 6 months, particularly if aided by phosphatic manures, but by combining them with "natural" covers an even quicker covering of the soil is achieved. By using a 'light' burn far fewer seeds and young forest plants are destroyed, and the establishment of 'natural' covers is made easier and less dependent upon fortuitously borne seeds.

The retention of timber and jungle débris, provided it is not so dense as to *smother* any new plant growths, provides cool and shady spots which are particularly favourable to newly germinating seeds and spores, and in any new clearing, the first

places where ferns appear are on the undersides of timber, along drain edges, etc.

The value of mulching to young Rubber plants is considerable on all soils, but is greatest on the sandy loams, derived from granite or quartzite rocks, and also in the drier parts of the country.

Experimental planting areas which were planted in 1937 have demonstrated where rainfall has been very unevenly distributed that manuring and soil type have had little effect on the development of the Rubber plants, but that soil moisture has been the limiting growth factor. This has been particularly noticeable in Central and South Johore districts.

Experiments have clearly shown that cover crop roots by competing with the Rubber for moisture, will severely retard the Rubber plants, although this can be reduced by 'slicing;' the following figures indicate the benefits arising from mulching. The experiment was laid down in a flat, heavy loam soil, and mulching was not commenced until 7 months after planting when the Rubber and the cover were well established.

Heights in inches.

| | May | June | July | Aug. | Sept. |
|---|---|---|---|---|---|
| Mulched | 73.2 | — | 97.6 | 106.4 | 120.7 |
| Not mulched | 75.7 | — | 100.0 | 104.7 | 118.3 |
| Rainfall (inches) | 6.5 | 2.4 | 2.5 | 5.5 | — |

Height increments in inches.

| | May/July | July/Aug. | Aug./Sept. |
|---|---|---|---|
| Mulched | 24.4 | 8.8 | 14.3 |
| Not mulched | 24.3 | 4.7 | 13.6 |

The effect of the two dry months (June and July) on the growth of even these well developed and vigorous plants (average monthly growth 10 to 11 inches) is clearly shown, and of particular interest is the value of the mulching (which was first done in May) as shown by the very nearly doubled growth rate during July to August of the mulched over the unmulched plots.

The present recommendations, therefore, of using a light burn or scorch, retaining as much timber and débris as conveniently possible and using a mixed system of leguminous covers with 'natural' covers have the following objects in view:—

(1) to reduce soil erosion losses by utilising timber and by rapidly producing a cover.

(2) to encourage a quick regeneration of natural covers which will help in achieving (1) and also shade the soil and provide mulching material.

(3) by achieving (1) and (2) and maintaining soil fertility and soil moisture conditions, to produce the best possible growth in the rubber plants.

The main disadvantages lie in the tendency for the masses of débris to encourage rats and other pests, against which counter-measures may be an expensive item, and in the difficulty of carrying out adequate root disease work, after planting, where the amount of lying timber is considerable. Both these points are referred to in other papers.

The actual growth of rubber trees under different types of covers and methods of clearing jungle is being studied by the Institute on Experimental Planting areas, and an obviously important matter is the relative cost of the different methods of preparing the jungle land and of the subsequent weeding and upkeep work. The experiments have not progressed sufficiently yet to allow any definite conclusions to be drawn.

Regarding costs, it appears that between 'normal' burning and 'light' burning there is likely to be very little difference, but if clearing without any preliminary burning is attempted, the cost is very nearly doubled.

## WEEDING OF COVERS.

The weeding practices on Rubber plantations in Indo-China and in Dutch East Indies differ from those of Malaya for the first year after planting, in that the land is generally kept clean weeded for that period, the object being to reduce competition.

This practice is not endorsed; the reduction of competition can be achieved by maintaining a cover under suitable weeding methods.

Competition from a cover crop has the greatest retarding effect on rubber plants during their first few years of growth while they are endeavouring to establish their root systems in the soil, and during those years everything must be done to reduce that competition.

The ideal arrangement would be to weed the cover in constantly widening circles or strips so that the cover crop roots never interfere with the Rubber roots.

Whilst this is not attainable in practice, a satisfactory compromise can be reached by commencing with clear circles around plants which are widened up to 8 ft. diameter and then formed into clear strips of the same width at 2 years from planting. At the same time soil mulching on the bare soil and, if necessary, 'slicing' along the edges of the cover will prevent undue drying of the uncovered soil and ensure that no underground root competition takes place.

It must be emphasized that these operations are of most importance during the first few *months* of the Rubber plant's life, and after a year or two, the Rubber tree's root system should be developed well enough to stand a fair amount of competition and the foliage, provided that the planting has been sufficiently close and that the clone used branches fairly quickly, will be closing in and helping to control the covers and reduce the competitive effects.

## MANURING

A large number of manuring experiments on virgin jungle land of different soil types have been commenced in 1937 by the Soils Division, and these indicate that little or no manuring of the Rubber plants is required during the first 6 months after planting.

On certain soils, particularly the loams and clay-loams derived from quartzite rocks, phosphate manuring produces quite definite height increases (10 per cent), but as a general rule manuring during the first 12 months can be omitted.

# RECOMMENDATIONS ON THE CHOICE OF PLANTING MATERIAL, CLONES AND CLONAL SEEDLINGS*

## GENERAL CONSIDERATIONS

DURING the past two years the relative merits of buddings and clonal seedlings (seedling families derived from good parent clones) for use in large-scale planting, on replanted and on new areas, have been the subject of much discussion.

It may be stated at once that we shall have no preference for buddings over "clonal" seedling families or *vice versâ* when it has been demonstrated, by reliable comparative tests, that the seedling families are equivalent in value, both in production and in secondary characters, with buddings of the best proved clones. When this has been established and a satisfactory method has been developed for producing with certainty large quantities of seed of the same parentage as the small families which have been tested, then commercial planting of the best families of clonal seedlings may be undertaken with safety.

For the present, the *legitimate* seedling families which have been proved to be equivalent in yield and in other important characters, to buddings of the best proved clones, such as Tjirandji 1, Prang Besar 86 and Pilmoor B. 84, are very limited in number. Until quite recently, no satisfactory method of producing seeds of these valuable families on a sufficiently large scale to provide the large quantities of seed required for commercial planting had been demonstrated. We still await proof of the relative value of clonal seedlings and buddings of the best proved clones planted and treated under strictly comparable conditions.

* Paper by C. E. T. Mann, Rubber Research Institute (Malaya) at the Fourteenth Annual Conference of the Incorporated Society of Planters, Kuala Lumpur, held on September 23-25, 1938, at Penang.

Thus, our present knowledge of the value of the best clonal seedling families in practice is about equivalent to our early knowledge of buddings some eight years ago, so that in general, the clonal seedlings available for commercial use must be regarded as unproved material.

The extensive planting of unproved material cannot be justified. We, therefore, strongly advise against the planting of clonal seedlings, in preference to buddings, on more than an experimental scale.

It is appreciated that there are many practical planters who still retain that which, for want of a better expression, we will call their prejudice against buddings and who will take the first opportunity to revert to the older practice of seedling planting.

It would be unwise to discourage completely the planting of promising clonal seedling families, for it is only by extensive trial under many and varied conditions that the relative value of such material can be assessed with certainty. *Nevertheless, we strongly advise even those who are prepared to risk the commercial planting of promising, but virtually unproved, material that the area allotted to such planting be limited in the maximum to twenty per cent of the area to be planted.*

In view of the keen general interest in the merits of clonal seed further salient facts, relating to the development and large-scale production of seedling families, are recapitulated here.

By means of carefully controlled artificial pollination (by hand) limited numbers of very promising families of clonal seedlings have been obtained and tapping tests, covering several years have shown that the best of these seedling families may give yields equivalent to those of the best clones. The demonstration of this important fact has been given a great deal of prominence and as a result, a strong impression has been created in many quarters that the time has now arrived to abandon the planting of buddings in favour of clonal seedlings. This impression is unfortunate and, in our opinion dangerous, for it is ill-founded. It is a great pity that other essential facts relating to the development of the best seedling families have not, in general, been given sufficient emphasis. It is therefore emphasised now that *only a few of the original families of colonal seedlings, obtained by carefully controlled hand-pollination, have been shown to be equivalent in productive capacity with buddings of the best proved clones.* The majority of the most promising seedling families (legitimate seedlings) are not more than 10 years

old and our knowledge of their performance is limited, in most cases, to about 5 years' tapping experience; whilst for the best of the proved clones over 10 years' experience of tapping has been obtained, supplemented, for most clones, by further tapping experience on large numbers of younger trees of successive "vegetative" generations.

Working on the assumption that it would prove impracticable to produce sufficient quantities of seed by means of artificial (hand) pollination to provide material for commercial planting, various means have been tried in order to raise large quantities of seed of known, or at least partially-known, parentage in the hope that the success of the small-scale investigation could be repeated on a large scale. The principal method employed, — the establishment of isolated gardens planted with a limited number of carefully selected parent clones, — has given promise of success. It remains to be proved however, to what extent the mass-production of seed from isolated gardens will reproduce the desirable results of the small families of seeds obtained by carefully controlled crossing between pairs of selected parents.

An example will serve to illustrate the wide variation in the composition of the seedling progeny which may be obtained from a typical isolated garden. In such a garden planted with 10 selected parent clones the possibility exists that 100 different families of seedlings (including reciprocals and selfs) may be produced. The actual number of these families which have been raised and studied by means of artificial pollination represents as a rule, a very small proportion of the total. The proportion of the total seed crop which consists of the tested families will be quite unknown and therefore it is essential that the value of the progeny of such a garden be tested and proved in much the same manner, and for as long a period, as a promising new clone requires to be tested before planting on a large commercial scale can be justly advised.

It may certainly be assumed that the seed progeny of a garden planted with well-known parent clones will be greatly superior to ordinary unselected seed but it cannot be assumed that such material will be equivalent in value to the buddings of the best proved clones. Preliminary tapping tests on material from isolated gardens have given the most encouraging results but we still await final proof of their true commercial value.

It has been stated above that the system of planting isolated seed gardens was based, in part at least, on the assumption that artificial hand-pollination for the production of seed in commercial quantities would prove impracticable. Recent attempts to produce large quantities of seed by hand-pollination, which have been made principally in Java, have met with considerable success. Already a number of enterprising estates have successfully trained large gangs of coolies in the simple, though tedious, technique of hand-pollination and during the current season large areas will be planted with legitimate crosses of the best of the high-yielding families of seedlings which have been obtained by the earliest investigators. (Further details of the technique and organisation of this work will be supplied on request).

A number of valuable high-yielding seedling families have now been under test for several years so that on estates where mature buddings of the parent clones of these families are available hand-pollinations may be made in large numbers with the certainty that seedlings of the same value as those originally tested will be obtained.

Reference to the Annual Report of the Rubber Research Institute for 1937 illustrates clearly that same cross, for example B.84 × A.44, has given seedlings of the same order of merit during three successive seasons (p. 112, Table XIV).

*Only legitimate seedlings, that is to say seedlings obtained by controlled crossing by hand, of the best of the legitimate families which have been already "proved" by tapping tests extending over several years, can at present be regarded as the possible equivalent in value of buddings of the best proved clones.*

All other clonal seedlings must be regarded as unproved material and no claims that such seedlings are of equal value with buddings of the best clones have yet been substantiated.

The general recommendations on choice of Hevea planting material which are given below are based on the considerations detailed above.

## I.—BUDDINGS

It is impossible to select from the large number of proved clones available for large-scale commercial planting one clone which may be regarded as the "best" for all situations but it is now possible to make a broad distinction between clones which have given promise of excellent performance under a wide range of conditions and those which appear to be particularly adapted to certain specified conditions.

For convenience, Clones are classified in two Groups A and B, but it must not be assumed that clones of Group B are necessarily inferior to those of Group A. In fact, it is quite likely that clones of Group B, when grown under conditions more favourable to themselves than to those of Group A, may prove superior to them.

*A. Clones.*—Tjirandji 1, Tjirandji 16, Prang Besar 86, Pilmoor B.84 and Prang Besar 25.

*B. Clones.*—Glenshiel 1, Pilmoor D.65, Prang Besar 186, Sabrang 24, A.V.R.O.S. 49, Lunderston N, and Bodjong Datar 5.

Full details of the yield records and other characteristics of the clones enumerated above have been published elsewhere but the principal characters and notes on the environmental conditions which appear best suited to these clones are given in brief below.

The Institute is always willing to give more detailed information and advice on questions of selection and disposition of clones for specific areas.

GROUP A.

*Tjirandji 1.*—On the basis of the original yield records of the first buddings of the clone, planted in 1920, and from the early records from comparative tests on younger trees, Clone Tjirandji 1 has proved to be the highest-yielding clone available for general commercial planting in Malaya. The clone is a vigorous grower under a wide range of conditions. Its principal defects are susceptibility to mechanical damage, very pronounced fall in yield during wintering and, during certain seasons, a tendency towards troublesome late flow of latex after tapping.

None of these secondary defects is in our view, sufficiently serious, at least in Malaya to detract greatly from the primary value of the clone as a very high producer.

*Tjirandji 16.*—This clone is the same age as Tjirandji 1 and has also proved a very satisfactory clone under a wide range of conditions. Though less robust in growth than Tjirandji 1, clone Tjirandji 16 does well on all except the poorest soils. Resistance to mechanical damage is very good, and yields do not fall heavily in the wintering season. Early yields are about equal to those of Tjirandji 1 but the rate of increase in yield is less impressive.

*Prang Besar 86.*—Established in June, 1923, this clone appears to be the best all-round clone in the original Prang Besar collection. So far as we are aware the clone has developed no defects which merit special mention. Its habit of growth makes it satisfactory for all conditions; it does well on the rich alluvial clay soils in the coast districts and is satisfactory on the rather poor quartzite soils on hilly inland estates.

*Pilmoor B.84.*—Planted in November, 1924, this clone probably possesses the most satisfactory vegetative characters of any of the older proved clones. In vigour of growth it is superior to Tjirandji 1; bark characters are excellent and resistance to mechanical damage is entirely satisfactory. Growth, after the first year, is excellent on all types of soil and the clone may be generally recommended with confidence. Comparative tests carried out in Sumatra, Java and Malaya have shown that Pilmoor B.84 is only slightly inferior in yield to Tjirandji 1 in the early years of tapping; the results of these independent tests are in striking agreement and it is interesting to record that Clone B.84 is recommended as one of the first choice of clones for large-scale planting in all three countries.

*Prang Besar 25.*—The original buddings of this clone, planted in April, 1922, have a very satisfactory history. Although in the early years, up to the age of eight to nine years, the trees are liable to suffer from storm damage this weakness appears to be overcome with maturity. Young buddings have grown well in a variety of different situations and yields on good soil areas are outstanding. In one large-scale tapping experiment, on an area of 60 acres, during the first 9 months of the fifth tapping year the actual crop harvested has been 1,090 pounds per acre which is at the rate of 1,450 pounds per acre per annum. Bark renewal is exceptionally good in Clone P.B. 25.

GROUP B.

*Glenshiel 1.*—Established in late 1921, Glenshiel 1, is a very satisfactory clone of medium vigour of growth. Very resistant to mechanical damage, the clone appears to be particularly well suited to the alluvial soils of the coastal plains. Its only notable defect is that it will not maintain its good performance on the standard tapping system employed in all clone-testing experiments, namely alternate day tapping on half circumference. However, since we have records from certain areas which show that even when tapped every 3rd day on half circumference the yield of Glenshiel 1 may be equal to that

of Tjirandji 1 we do not regard this weakness of the clone with any anxiety.

*Pilmoor D.65.*—This clone was planted in November, 1924 and has been grown and tested with Pilmoor B.84. Until two years ago, D.65 gave slightly higher yields than B.84 but its vigour of growth and secondary characters, particularly bark renewal, are not so good as those of B.84. Early observations on young areas indicate that this clone may be one of the most suitable for the coast districts.

*Prang Besar 186.*—Established in April, 1922, P.B. 186 was for many years considered to be the best clone of the Prang Besar collection. It was however, realised from the outset that the bark characters of the clone were not entirely satisfactory. Experience of commercial tapping of young budded areas of P.B. 186 have recently shown that defects in bark renewal, due to characteristic swellings near the dormant buds at the tapping level, may be more serious than we had originally anticipated. For general use therefore, we no longer recommend this clone, but on estates on which experience has already shown that the clone can be grown successfully, so that the pronounced irregularity of the trunks is not evident, then further planting of P.B. 186 on similar land may be advised. On unfavourable soils the defect described is generally more in evidence so that we prefer to advise against the planting of this clone no areas where no previous experience of its development is available.

*Sabrang 24.*—This clone has proved a satisfactory clone on coast land estates where it was first established in late 1921. Although the clone has not been widely used young buddings of Sab. 24 have also grown well on good inland areas but on poorish sandy soils, growth has been less satisfactory. Yields are satisfactory but not outstanding — the clone appears to be of about the same order of merit as A.V.R.O.S. 49.

*A.V.R.O.S. 49.*—This clone is one of the oldest of the original A.V.R.O.S. series, established in January, 1919, and planted consistently in Sumatra until the present year. It has now been omitted from the most recent recommendations for the choice of planting material. A clone of medium productive ability A.V.R.O.S. 49 is regarded as a good sound clone with no notable defects. The tendency for lumping and premature coagulation of latex to occur during the first year or two of tapping is troublesome in practice but cannot be regarded as a really serious defect.

*Lunderston N.*—Although little known at present, Clone Lunderston N was established in March, 1923 and regular tapping and recording of yields has been continued since 1928. Planted on a very poor peat-clay soil on Lunderston estate the actual yield performance of the trees did not compare favourably with that of other proved clones and therefore attracted little attention. Recent tapping results on younger buddings in comparative tests on different soils have shown that the yields of Lunderston N may prove outstandingly good under better conditions. The clone is of particular interest in view of the excellent results we have obtained from seedling families and from new clones derived from seedlings, of which Lunderston N, is one of the parents.

*Bodjong Datar 5.*—Clone B.D. 5 is one of the oldest proved clones known. Established in February, 1918 tapping tests on the original buddings of the clone have been continued without a break since 1924 and yield records are available from 1926 up to the present time. A clone of slow development and slow rate of girth increase, the method of assessment of budded areas employed in Malaya by which potential production was based on girth measurements has done much to bring disfavour on B.D. 5. We still have great faith in the future of the older areas budded with this clone and where previous experience has shown growth to be satisfactory, generally on the best soil areas, further planting of the clone may still be recommended. Generally speaking however, the slow early development and consequent low early yields, must be regarded as a rather serious disadvantage and younger clones of more robust growth and higher early production must be given preference.

## SEEDLING FAMILIES

Our views on the planting of clonal seedlings have been given somewhat fully in the introduction to these recommenda tions. A list of promising legitimate families and illegitimate collections of clonal seedlings is given for those who wish to plant seedling material.

### LEGITIMATE SEEDLING FAMILIES (Derived from proved clones by hand-pollination)

*Tjirandji 1 X Tjirandji 16.*—The first crosses of this family were made at the Proefstation, West-Java. A group of some 400 trees of this family has been in test for nearly 4 years. Yield records are very good the yields of the seedlings approach

closely the yields of buddings of Clone Tjirandji 1 at comparable age.

*Tjirandji 1 X Tjirandji 1.*—(Selfed seedlings of Clone Tjirandji 1).—Although only a small group of seedlings of this origin are under test their yields are outstandingly good and compare favourably with those of the Tjirandji 1 & Tjirandji 16 crosses.

*Pilmoor B.84 X Pilmoor A.44.*—Crosses of this family give high average yields but the value of the family is marred to a certain extent by the too frequent appearance of the undesirable bark and trunk characters of the parent A.44.

*Pilmoor A.44 X Lunderston N.*—This family gives rather uniformly high average yields. A number of very promising new clones have been derived from seedlings of this cross.

*A.V.R.O.S. 157 X A.V.R.O.S. 161.*—One of the highest yielding families of the original series of crosses made by Heusser at the A.V.R.O.S. Experiment Station in 1921.

*A.V.R.O.S. 166 X A.V.R.O.S. 161.*—This is another of the outstanding crosses of the original series made by the A.V.R.O.S. in Sumatra.

The above list includes the principal outstanding families of which the parent trees are available in Malaya and concerning which detailed records have already been published. Other very promising families have also been tested in this country and in Java but either the parent trees are not available for use in Malaya or, details of the origin of the parentage of the families have not been published.

**ILLEGITIMATE SEEDLINGS** (Derived from proved clones by natural pollination)

When the identity of only one parent of a seedling, the mother tree which bears the seed, is known with certainty then such seed is defined as *illegitimate seed*. In this category we must include seed from isolated gardens planted with more than two clones, duo-clone plantings where there is any risk whatever of pollen from outside sources reaching the seed bearing trees, and seed from mixed plantings of clones.

**ISOLATED GARDEN SEED** (Seed from a number of parent clones by natural pollination)

In the absence of sufficient yield data and observations on the secondary characters of seedlings grown from isolated garden

seed our estimate of the probable value of such material can only be based on our knowledge of the parent clones, and of their progeny from the results of preliminary breeding experiments with them, which compose the garden.

Unfortunately, detailed information on the composition of the seed garden is not available for all gardens from which clonal seed is being offered for sale so that it is impossible for us to make specific recommendations in regard to the choice of such material.

## OTHER SUPPLIES OF ILLEGITIMATE CLONAL SEED

There are a number of commercial plantings of buddings of certain clones which have been used as parents of very promising families. In some instances duo-clone plantings containing two good parent clones such as Pilmoor A.44 and B.84, are now producing considerable crops of seed. The chances are that seed from the centres of such areas are likely to consist largely or true crosses of valuable clones. Such material is worth attention and planting on a small experimental scale can be recommended.

Further advice on the use of clonal seedlings and also advice on the probable value of the seed obtained from large commercial plantings on estates will be given on request. It may be stated, in order to encourage investigation of potential sources of supply of valuable seed, that there is as yet little evidence to show that, for practical purposes, the mixed seed crop obtainable from the centres of a large commercial area which have been planted entirely with buddings of the best proved clones will be inferior to that obtainable from isolated seed gardens planted with a similar collection of clones.

The present paper deals exclusively with the choice of planting material for use in large scale new plantings or replantings during the year 1938-1939.

No mention has been made of other aspects of new planting such as selection of stocks for budding, methods of planting, introduction of new clones and the like. These subjects may be raised in discussion if desired and may form the subject of a further paper to be published at a later date.

# SUMMARY OF CLONE AND SEEDLING FAMILY TRIALS ON POLONIA.*

THIS paper gives an account of the test tapping results and other observations on a large number of clones and illegitimate seedling families planted on the A.V.R.O.S. Experiment Station, Polonia. The yields and other data relating to the clones and seedling families of most interest to Ceylon producers are presented in Table I, units of yield and area being translated respectively from kilogrammes and hectares to pounds and acres.

## PLANTING

1927: approximately 25 feet × 13 feet giving 137 trees per acre.

1928, 1929, 1930, 1931 (excluding seedlings): approximately 22 feet × 15 feet giving 134 trees per acre.

1931 seedlings: approximately 21 feet × 13 feet giving 162 trees per acre.

Planting was with budded stumps and stumps respectively.

## THINNING

At about six years old the plots were thinned on the basis of yield to about 105-109 trees per acre, the same proportion of trees being removed in each clone.

## TAPPING SYSTEM.

Alternate daily (except on alternate Sundays) on a half spiral cut, giving a total of 155-163 tappings in the year.

On trees suffering from Brown Bast the cut was shortened to $\frac{1}{3}$ circumference. If more than 30 per cent of the trees of any clone developed this disease the whole clone was put on $\frac{1}{3}$ circumference. The clones thus treated are B.D.2, Tjirandji 1 and Glenshiel 1.

## CALCULATION OF YIELD PER ACRE.

The yield per acre has been computed from the yield per tree and the number of trees in tapping in a measured area. Where the growth of a clone is slow, thus reducing the proportion

[*Extracts from a paper entitled "Summary of Clone and Seedling Family Trials on Polonia up to the end of 1937," by Ir. J. F. Schmöle in Archief voor Rubbercultuur Vol. 22, No. 3.]

of tappable trees, the ratio of yield per acre to yield per tree suffers by comparison with a vigorous clone. Similarly for a clone such as P.B.86 in which a number of trees have been lost by wind damage. Only where the number of trees in tapping has been reduced by some accidental circumstances is an adjustment made. It is thus considered that the figures for yield per acre have greater practical significance than those for yield per tree. The figures, however, must be regarded with some reserve on account of the small areas involved.

### GROWTH

Growth has been compared with that of the "standard" clones A.V.R.O.S.49 and A.V.R.O.S.256. It is described according to the following scheme:—

| | | | | |
|---|---|---|---|---|
| Girth more than | 100% | of "standard" | clone: | very good |
| ,, | 96-100% | ,, | ,, | good |
| ,, | 91-95% | ,, | ,, | fairly good |
| ,, | 86-90% | ,, | ,, | rather weak |
| ,, | 81-85% | ,, | ,, | weak |
| ,, | less than 81% | ,, | ,, | very weak |

### WIND DAMAGE.

The figures include breakages of the main stem or one or more of the main branches. (It may be noted that wind damage is a more serious matter in the East Coast District of Sumatra than in Ceylon).

### BARK RENEWAL.

Notes are given on the outward appearance of the renewed bark and not on its thickness. By "good" bark renewal is meant an attractive, flat surface free from knobs and ridges. The term "ridges" is meant to describe long, more or less vertical, raised ridges on the renewed panel as, for instance, in A.V.R.O.S.49. Slight ridge formation is unimportant, but marked ridges may seriously interfere with tapping.

### WOUND RECOVERY.

Under this heading is given information on the recovery from wounds due to tapping or panel diseases.

In Table II are given some yields from small monoclone blocks.

TABLE I

| Age (Years) | | 5th | | | 6th | | | 7th | | | 8th | | | 9th | | | 10th | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clone | Year of planting | No. trees in tapping | Yield in lb. per tree | Yield in lb. per acre. | No. trees in tapping | Yield in lb. per tree | Yield in lb. per acre | No. trees in tapping | Yield in lb. per tree | Yield in lb. per acre | No. trees in tapping | Yield in lb. per tree | Yield in lb. per acre | No. trees in tapping | Yield in lb. per tree | Yield in lb. per acre | No. trees in tapping | Yield in lb per tree | Yield in lb per acre |
| Glenshiel 1 | 1930 | | | | 13 | 4.8 | 420 | | | | 1/3 sp. a.d. tapping | | | | | | | | |
| Pilmoor B. 84 | 1930 | 19 | 6.2 | 700 | 21 | 7.5 | 960 | 18 | 14.7 | 1,600 | | | | | | | | | |
| P. B. 23 | 1930 | | | | 17 | 5.5 | 580 | 17 | 7.9 | 810 | | | | | | | | | |
| P. B. 25 | 1930 | | | | 18 | 6.6 | 710 | 18 | 9.7 | 1,030 | | | | | | | | | |
| P. B. 86 | 1931 | 11 | 5.9 | 400 | 16 | 8.1 | 740 | | | | | | | | | | | | |
| P. B. 183 | 1931 | 17 | 3.7 | 370 | 17 | 5.9 | 590 | | | | | | | | | | | | |
| P. B. 186 | 1930 | 17 | 4.0 | 410 | 22 | 6.6 | 890 | | | | | | | | | | | | |
| Rubana 393 | 1930 | | | | 16 | 4.6 | 450 | 14 | 8.1 | 690 | | | | | | | | | |
| Sabrang 24 | 1930 | 14 | 3.7 | 310 | 20 | 6.4 | 770 | 18 | 10.8 | 1,170 | | | | | | | | | |
| ditto | 1930 | | | | 18 | 5.1 | 560 | 17 | 9.7 | 990 | | | | | | | | | |
| B. D. 2 | 1928 | | | | 19 | 5.3 | 610 | 18 | 6.4 | 690 | 18 | 8.8 | 970 | 17 | 9.2 | 950 | 1/3 sp. a.d. tapping | | |
| ditto | 1929 | | | | 20 | 5.3 | 640 | 18 | 7.3 | 800 | 18 | 9.0 | 980 | | | | | | |
| B. D. 5 | 1928 | | | | 17 | 8.5 | 770 | 17 | 9.0 | 940 | 17 | 12.3 | 1,280 | 17 | 14.7 | 1,490 | | | |
| ditto | 1929 | | | | 12 | 6.6 | 490 | 17 | 8.6 | 870 | 17 | 11.2 | 1,170 | | | | | | |

# REVIEW

**Practical Replanting of Rubber.**—By E. W. Whitelaw. The Times of Ceylon Co., Ltd., 1938. Price Rs. 7-50.

THE Replanting of Rubber is an agricultural practice of comparatively recent development, and it presents to the average estate superintendent a number of problems and difficulties to the solution of which his previous "planting" experience, often consisting only of routine operations in mature areas, affords little guidance. He has good reason, therefore, to be grateful to Mr. Whitelaw for placing on public record a comprehensive series of notes on all operations connected with this practice, these notes being the outcome of experience over a period of several years and on estates in a number of districts.

Mr. Whitelaw strikes a good note at the commencement (in the introduction) by urging the desirability of superintendents taking the initiative in proposing modifications of standard practices to suit local conditions. We believe that there is now a greater tendency for those responsible for estate policy to be guided by the views of "the man on the spot."

Starting with a chapter on the advantages that may be expected to accrue from the replanting of obsolescent trees with high yielding budgrafts, the author proceeds to a consideration of the preliminary arrangements for replanting. He rightly emphasises the fact that if the work is to be carried out with the maximum efficiency and economy a programme must be formulated well in advance of the actual felling operations, and the necessary nurseries prepared. A decision that has to be made at this stage is whether the planting is to be with budded stumps or with seed for subsequent budding in the field. In expressing a preference for the latter procedure the author does not appear to give due weight to the financial gain in bringing the trees into bearing a year or even 6 months earlier on which

he places great emphasis in another connection. We do not agree that 15 to 20 per cent, casualties is "certain" to occur when planting budded stumps if the planting is done correctly and carefully. The suggestion, if the choice falls on field budding, of gaining time by procuring seed from Moneragalla in January is an excellent one.

The largest chapter is devoted to a detailed description of the replanting operations, and it is on these practical matters that Mr. Whitelaw's observations are of special value. He also contributes very useful notes on manuring, characteristics of clones, pests and diseases and a number of valuable miscellaneous suggestions based on personal experience.

In a publication on this subject, so many aspects of which are controversial, it is inevitable that not all the statements of fact and opinion can be accepted without question. There are also a few minor inaccuracies.

On the subject of the removal of grass, it is not altogether correct to say that this type of cover causes actual deterioration of the soil. Although we are in agreement with the view that it should be replaced by leguminous covers as expeditiously as possible, there are circumstances in which the removal of the grass over the whole area in one operation would be inadvisable on account of subsequent soil erosion. It is usually possible to replace grass by a creeping cover in stages which do not at any time leave a large area of soil uncovered.

The author bases his arguments against the incorporation of fresh green material in the soil on the assumption that in the process of decomposition the soil will be deprived of bacteria. In actual fact the bacterial population is much increased, but unless the ratio of carbon to nitrogen in the green material is favourable the soil is temporarily deprived of nitrogen to build up the bodies of the additional bacteria. With leaves and green stems of leguminous covers the C/N ratio is such that no loss occurs, but it is nevertheless sound practice, as the author suggests, to supply a little added nitrogen in the form of calcium cyanamide.

In his description of the contour trench system of planting Mr. Whitelaw states that the trenches should be completely filled at the end of the second year. Our present view is that the trenches should never be completely filled.

Mr. Whitelaw deals fully with the question of costs and the only comment to be made is that in the summary he has apparently included the cost of budding (Rs. 8-50 per acre) in both the first and second year.

In the chapter on manuring there is the obvious criticism, which the author himself anticipates, that a large proportion of the fertilisers recommended are of organic origin. The information so far available indicates that the inorganic forms of manure are more efficient on a cost basis. The reviewer is not aware that B.D.5 shows a special clonal susceptibility to phosphate manuring though it seems that this nutrient is the main requirement of all young Hevea plants in most of our soils.

Mr. Whitelaw's recommendation that the roots of the old trees should be inspected immediately after felling for any evidence of discoloured tissue is a valuable one, though this proceeding is unlikely to disclose all the dormant infection. The removal of the old lateral roots is considered to be a more effective precautionary measure than he would lead us to suppose, but it is doubtful if the presence of timber *above* ground is a material factor. Moreover, decaying rubber logs are most unlikely to provide breeding places for the harmful cockchafer grub *Lepidiota pinguis*, though they are readily infested by the Coconut beetle *Oryctes rhinoceros* which does not attack Hevea.

The term "chlorosis" denotes a blanched condition of the leaf in which the chlorophyll is not normally developed; excessive alkalinity of the soil is only one of the causes of this condition.

The author's comments on the value of the various imported clones are very sound, but it may be mentioned that some of the so-called "lesser known" clones are, in fact, amongst the oldest and most fully tested clones. Some of them have been discarded on account of undesirable features and others, although not unsatisfactory, have been superseded by higher yielding material. The idea of establishing on every estate a "museum" collection of imported and local clones of possible commercial value is excellent provided every possible precaution is taken to avoid confusion between them. Some of the Ceylon clones suggested for such a collection, however, are considered unlikely to prove of economic value.

There is a slight error in the table of yields of Clone Prang Besar 86. The original buddings of this clone are 18 months

younger than those of P.B.25 and 186, and the ages given should be altered accordingly, *i.e.* "6 years old" should read "$4\frac{1}{2}$ years old," etc.

These minor criticisms do not detract from the general value of the book which is both instructive and stimulating and can be highly commended to all estate superintendents with replanting work in progress or under contemplation.

The text is well illustrated with 25 photographs and a good index is provided.—R. K. S. M.

# MEETINGS, ETC.

## RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the forty-third meeting of the Rubber Research Board held in the Chamber of Commerce Building, Colombo, at 10 a.m. on Friday, 10th June, 1938.

*Present.*—Mr. E. Rodrigo, C.C.S. (in the chair), Messrs. L. B. de Mel, J.P., U.P.M., L. M. M. Dias, L. P. Gapp, F. H. Griffth, M.S.C., R. J. Hartley, Col. T. G. Jayewardene, V.D., Messrs. C. E. Jones, C.C.S., (Deputy Financial Secretary), R. C. Kannangara, M.S.C., F. A. Obeyesekere, J. L. D. Peiris, B. M. Selwyn, R. A. Sharrocks, and E. W. Whitelaw.

Mr. T. E. H. O'Brien, Director, was also present by invitation.

### 1. MINUTES

Minutes of the forty-second meeting which had been circulated to members were confirmed and signed by the Chairman.

### 2. BOARD

The Chairman reported that:—

(1). Col. T. Y. Wright had resigned and that Mr. L. P. Gapp had been nominated in his place with effect from 1st April.

(2). Mr. E. C. Villiers, M.S.C. had resigned at the end of April. A nomination to fill the vacancy had not yet been made.

(3). Mr. R. A. Sharrocks had been nominated by the Ceylon Estates Proprietary Association to act for Mr. J. C. Kelly during the period of Mr. Kelly's absence from the Island with effect from 27th April, 1938.

Messrs. Gapp and Sharrocks were welcomed to the Board by the Chairman.

### 3. DECISIONS BY CIRCULATION OF PAPERS

(1). *Appointment of Soil Chemist.*—Reported that the Board had, by circulation of papers, adopted the recommendation of the London Advisory Committee that the post should be offered to Dr. L. A. Whelan. Dr. Whelan had accepted the post and would arrive in Ceylon in October after a period of 3 months' training at Rothamsted Experimental Station.

(2). *Report of the London Advisory Committee for* 1937.—This had been approved by circulation of papers and would be printed with the annual report of the Board.

## 4. ACCOUNTS

(a). *Statements of Receipts and Payments of the Board and the London Advisory Committee*—for the quarter ended 31st March, 1938 were approved.

(b). *Dartonfield and Nivitigalakele Accounts*—for January and February, 1938 were tabled.

(c). *Cess Collection Receipts.*—The Chairman said that the present practice was for the Chairman to sign receipts for the cess collections received from Government each month. He suggested that the receipts be signed in future by the Director.—Agreed.

(d). *Fixed Deposit.*—The Chairman reported that, as decided at the last meeting, a sum of Rs. 60,000 had been placed on fixed deposit for 12 months from 27th April at 1½ per cent interest with the Imperial Bank of India, Colombo.

## 5. STAFF

Reported the arrival of Dr. C. E. Ford, the newly-appointed Geneticist, on May 30th, 1938.

## 6. EXPERIMENTAL COMMITTEE

(1). Recommendations made at a meeting held on May 2nd were considered.

(a). *Adoption of Consulting Engineer's Report.*—As recommended by the Committee the report was adopted.

(b). *Regulations for the Introduction, Multiplication and Distribution of Planting Material.*—The memorandum, as circulated to the Board, was adopted. A member enquired whether it was fully understood that in spite of these regulations it was not possible to guarantee absolute accuracy in identification. In reply it was pointed out that this was mentioned in the memorandum.

(c). *Fencing of Multiplication Nurseries.*—It was reported that the fencing had been completed, as recommended, at a cost of Rs. 889-80. A supplementary vote for this amount was passed.

(d). *Policy regarding the distribution of Planting Material.*—The policy recommended by the Committee in the memorandum dated 11th May, 1938, was approved subject to minor amendments.

A sum of Rs. 400 was voted for the introduction of new foreign clones.

(e). *Sale of Vulcanised Goods.*—The recommendation that the articles manufactured at Dartonfield be sold to selected local firms at wholesale rates was approved. The Director reported that he had offered the goods for sale to certain firms and had obtained some orders.

(f). *Sale of Concentrated Latex.*—The policy recommended by the Committee of selling concentrated latex to buyers in countries where patents are not in force was endorsed.

(g). *Brass Latex Sieves.*—The recommendation of the Committee that the attention of proprietary associations such as the Ceylon Estates Proprietary Association and the Low-Country Products Association be drawn to the dangers of using brass latex sieves for straining latex was approved.

(h). *Small Creping Mills for Rubber Samples.*—Reported that a set of second hand 12-inch mills had been offered for sale by an estate. An estimate for reconditioning the machines and installing them at Dartonfield had been called for but had not yet been received. A vote was approved for the purchase of the mills at the discretion of the Chairman.

(2). *Appointment of Acting Visiting Agent.*—The Chairman reported that Mr. P. R. May had gone on furlough and suggested that Mr. D. T. Angus be invited to act for him.—Agreed.

(3). *Identification of Clones.*—A proposal was considered for securing the temporary services of a trained conductor from the Rubber Research Institute of Malaya for the purpose of checking the identity of planting material on estates. The expense involved would be met by charging a small inclusive fee for each estate visited. The proposal was approved provided there was sufficient support from estates. It was decided that an advertisement should be issued in the press and information copies forwarded to local agency firms and associations, and that arrangements should be proceeded with if there were sufficient applications for the officer's services. The fee was fixed at Rs. 50 for the first day spent on each estate and Rs. 30 for each subsequent day.

## 7. REPORTS

Technical Officers' Progress Reports for the quarter ended 31st March, 1938 were adopted.

## 8. RESEARCH PROGRAMMES

The following research programmes were considered and adopted, subject to minor amendments : Chemical Department, Botanical Department, Mycological Department, Soils Department.

## 9. RUBBER CONFERENCE

Sanction was given for Research Officers to participate in a Rubber Conference which was likely to be arranged by the Kalutara Planters' Association later in the year.

## 10. PUBLICATIONS

The *First Quarterly Circular for* 1938 was tabled.

The meeting terminated with a vote of thanks to the Chamber of Commerce for the use of its building.

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# RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the forty-fourth meeting of the Rubber Research Board held in the Chamber of Commerce Building, Colombo, at 10 a.m. on Thursday, 8th September, 1938.

*Present.*—Mr. E. Rodrigo, C.C.S. (in the chair), Messrs. C. H. Collins, C.C.S., (Deputy Financial Secretary), I. L. Cameron, L. M. M. Dias, L. P. Gapp, Col. T. G. Jayewardene, V.D., Messrs. R. C. Kannangara, M.S.C., L. B. de Mel, J.P., U.P.M., C. A. Pereira, J. L. D. Peiris, B. M. Selwyn, R. A. Sharrocks and E. W. Whitelaw.

Mr. T. E. H. O'Brien, Director, was also present by invitation.

Apologies for absence were received from Messrs. R. P. Gaddum, M.S.C., and F. A. Obeyesekere.

## 1. MINUTES

(a) Minutes of the forty-third meeting which had been circulated to members were confirmed and signed by the Chairman.

(b) *Matters arising from the Minutes.*

1. *Identification of Clones* (Item 6 (3).)—Reported that arrangements had been made for the loan of 2 officers from the Rubber Research Institute of Malaya. The identifications would be made by a Chinese mandor who would be accompanied by a Ceylonese laboratory assistant.

2. *Rubber Conference* (Item 9).—Reported that the Planters' Association of Ceylon had agreed to sponsor the proposed conference and had asked the Kalutara Planters' Association to make all arrangements. The Conference would be held at Tebuwana on November 25th.

## 2. BOARD

Reported :—

(a). Nomination of Mr. R. P. Gaddum to represent the State Council in place of Mr. E. C. Villiers who had resigned, with effect from 20th June, 1938.

(b). Nomination of Mr. C. H. Collins to represent the Financial Secretary in place of Mr. C. E. Jones, with effect from 20th August, 1938.

(c). Resumption of seat by Mr. I. L. Cameron in place of Mr. R. J. Hartley, with effect from 15th July, 1938.

(d). Temporary absence of Mr. Geo. E. de Silva from Ceylon.

(e). Renomination of Mr. B. M. Selwyn, with effect from 10th July, 1938.

## 3. EXPERIMENTAL COMMITTEE

Recommendations made at a meeting held on 15th August, 1938, were considered :—

(a). *Building Programme for* 1939.—Recommendations of the Committee were approved as follows :—

*Senior Staff Bungalows*—Provision for another bungalow need not be made at present.

*Junior Staff Bungalows*—One bungalow to be constructed at Dartonfield.

*Field Laboratory for Geneticist*—Construction to be postponed until 1939.

(b). *Visiting Agent's Report.*—The report was adopted after a few minor points had been discussed.

(c). *Bridge to 7 acres field.*—An additional vote of Rs. 110-27 was approved.

(d). *Manufacture at Nivitigalakele.*—The proposal to provide for an additional smokehouse of the smallholders' type in 1939 estimates, was approved.

(e). *Experimental Manufacture of Vulcanised Products.*—It was agreed that semi-commercial manufacture at Dartonfield should be discontinued at the end of 1938, as recommended by the Committee. Approval was given to increase the advance account from Rs. 1,500 to Rs. 2,000.

(f). *Control of Oidium Leaf Disease.*—The Chairman stated that the Central Board of Agriculture had recently adopted a resolution in favour of the formation of Oidium Committees in severely affected districts, as recommended by the Oidium Committee in 1935. The proposal had led to considerable discussion at meetings of District Planters' Associations and was to be further considered at a Conference convened by the Planters' Association of Ceylon. It was, therefore, desirable for the position to be reviewed by the Board.

After discussion the following resolution was proposed by Col. T. G. Jayewardene, seconded by Mr. J. L. D. Peiris and was unanimously adopted :—

"In the opinion of the Rubber Research Board sulphur dusting is beneficial over a period of years despite poor results in any particular year due to unfavourable weather conditions. The imposition of compulsory control measures is neither practicable nor desirable."

It was decided that there was no need for the formation of District Committees in view of the above resolution. This decision was due to the conclusion that oidium infection could not be eliminated even by concerted action.

(g). *Exchange of Clones.*—It was agreed that material of promising local clones should be exchanged with the Rubber Research Institute of Malaya on such conditions as may be imposed by the Institute in respect of material sent to Ceylon.

## 4. ACCOUNTS

(a). Statement of receipts and payments of the Board for the quarter ended 30th June, 1938, were adopted.

(b). *Cash Balance.*—Reported that the cash balance on current account was down to Rs. 12,000 owing to the reduced income from cess collections. The Chairman was authorised to arrange for the surrender of a fixed deposit if and when necessary.

(c). Dartonfield and Nivitigalakele accounts for March, April, May and June, 1938 were tabled.

## 5. STAFF

(a). *Soil Chemist.*—Reported that Dr. L. A. Whelan had signed the service agreement, which would be sealed on behalf of the Board after the meeting. Dr. Whelan was due to arrive in Ceylon on or about October 16th.

(b). *Rubber Instructor.*—Reported the resignation of Mr. D. P. Gunawardhana with effect from September 1st. On the recommendation of the Smallholdings Committee it was agreed that the appointment be offered to Mr. H. B. Wijesundara.

## 6. NEW PLANTING

Arising from the questionnaire issued by the Rubber Controller on the above subject it was reported that provisional application had been made to plant 20 acres at Pinnagoda in 1940. It was now proposed to plant 10 acres in 1939; the extent of planting in 1940 would depend on the progress made by the Geneticist.—Approved.

## 7. AGREEMENTS FOR BUDWOOD

Reported that agreements had been signed by the Chairman in respect of Pilmoor and Prang Besar clones purchased with the approval of the Board.

Particulars of the clones concerned are:—

Pilmoor Co., Ltd., Clones D/65 and B/84.

Prang Besar Co., Ltd., Clones P.B.5/57, 5/60, 5/139, 6/9 and 6/50.

## 8. TRAINING IN RUBBER TECHNOLOGY

Reported that Mr. C. D. Dias had completed a period of 7 months' training. A report prepared by him at the end of the period was tabled.

## 9. REPORTS

Technical Officers' Progress Reports for the period ended June 30th, 1938 were adopted.

## 10. LONDON ADVISORY COMMITTEE

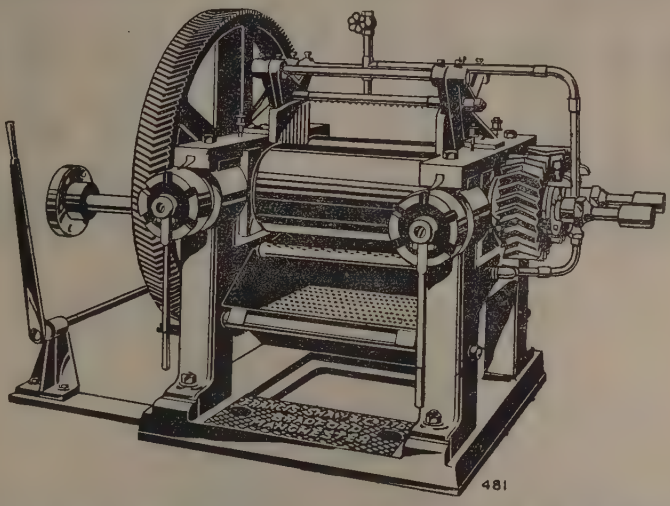
(a). Minutes of the Committee and Technical Sub-Committee meetings held on 29th April, 1938 were adopted.

(b). Reported that Mr. W. S. Davey, Chemist on the Committee's Staff at the Imperial Institute, had visited Ceylon from August 31st to September 7th. Physical testing methods had been discussed and compared, and Mr. Davey had given a short talk to the Kalutara Planters' Association on the work in progress in London.

## 11. PUBLICATIONS

*Second Quarterly Circular* for 1938 was tabled.

The meeting closed with a vote of thanks to the Chamber of Commerce for the use of the Committee Room.

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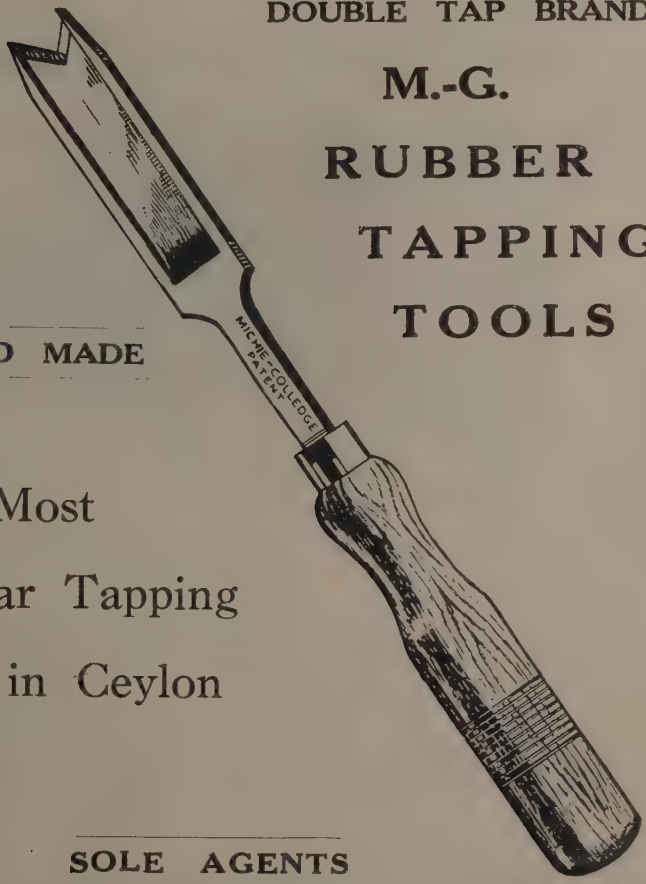


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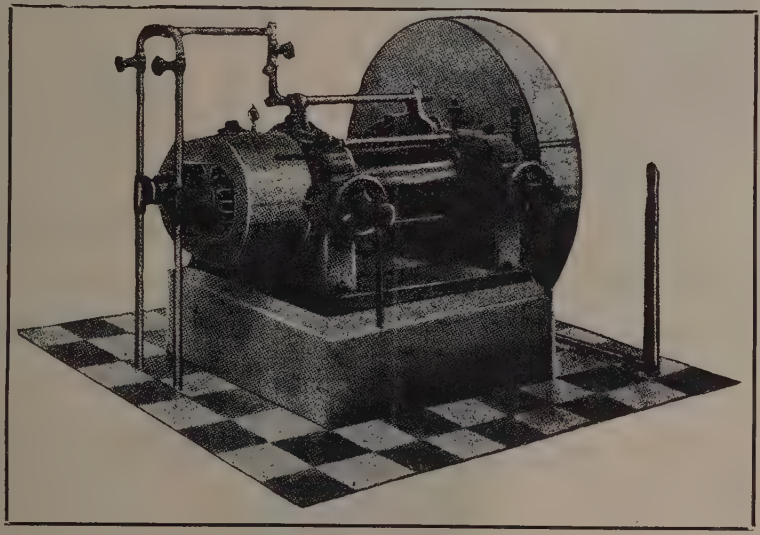

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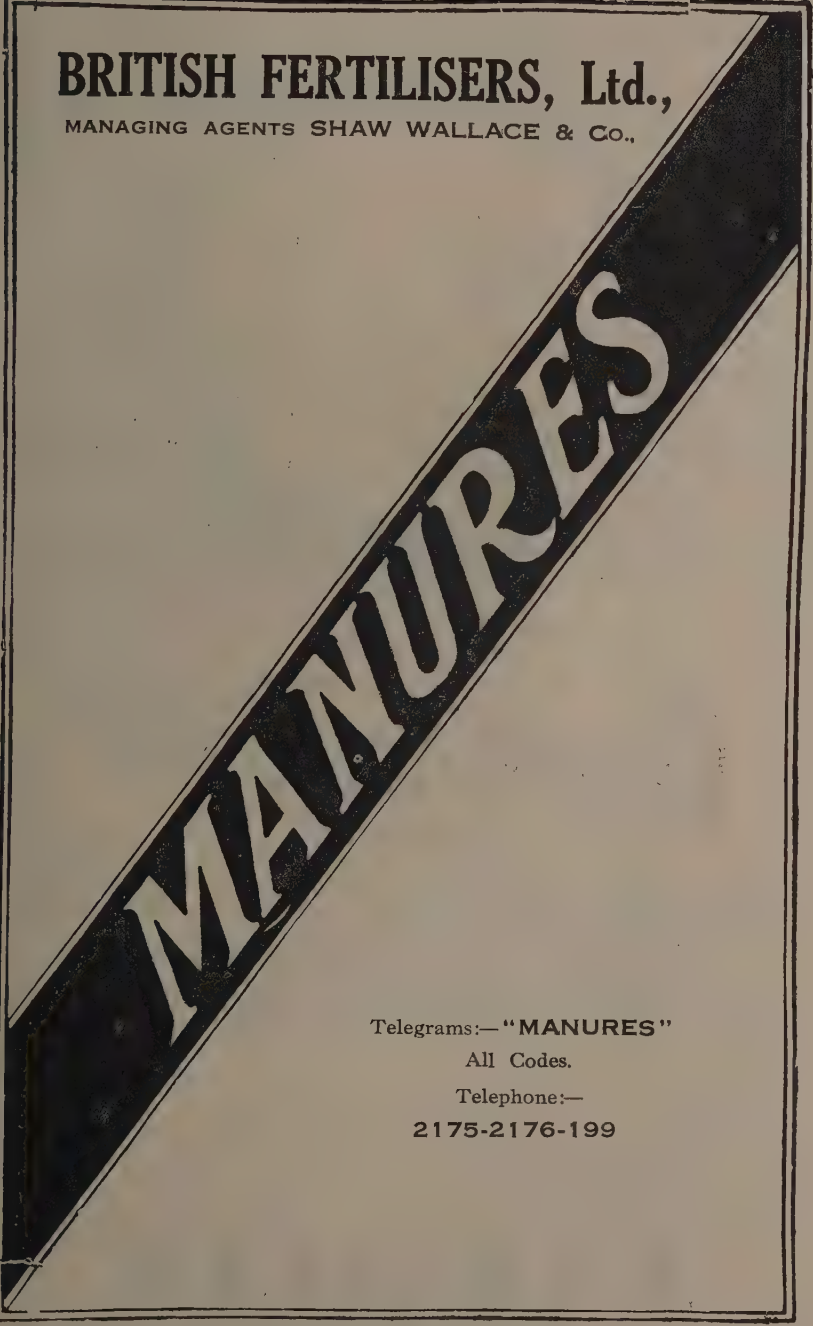


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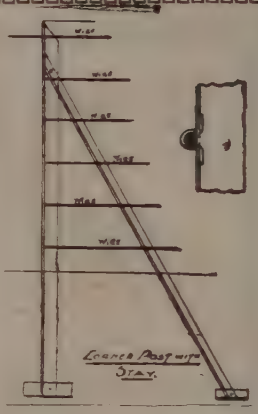

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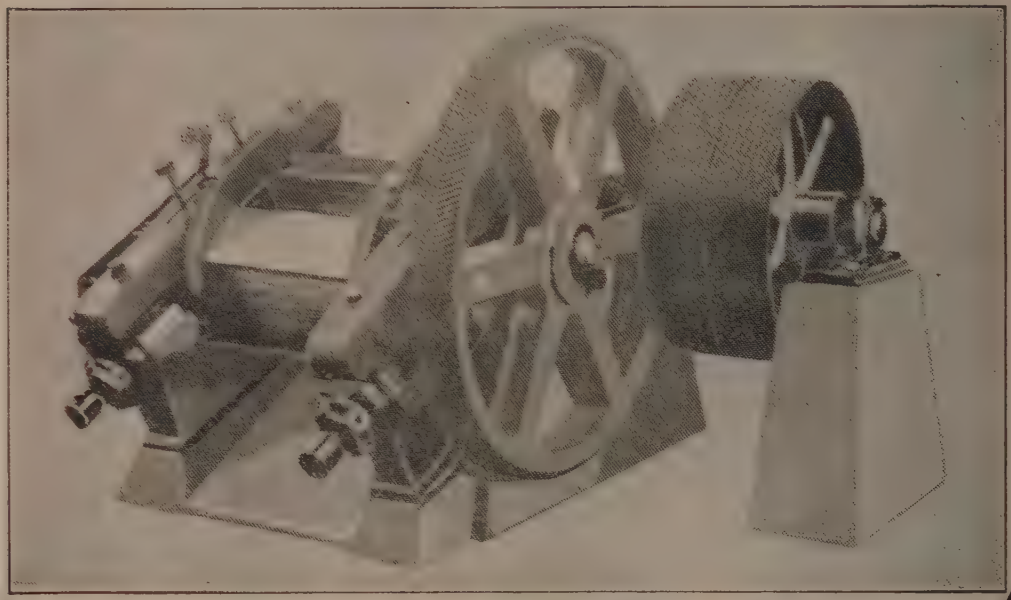

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Without POTASH

With POTASH

Treated with Nitrogen Phosphoric Acid and POTASH Budded September 1937. Photographed 29-8-38. Height from bud union :—8 feet 8 inches Girth (3 feet from ground level) 3 inches

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